FINAL REPORT

Energy Savings Opportunity Survey
Fort Leonard Wood, Missouri

EXECUTIVE SUMMARY

Department of the Army
US Army Corps of Engineers
Kansas City District

Contract No. DACA41-85-C-0112

May, 1987

Energy Masters Corporation
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DEPARTMENT OF THE ARMY
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Marie Wakefield,
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VOLUME

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EXECUTIVE SUMMARY

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INTRODUCTION

This report is the final submittal for work performed under Contract No. DACA41-85-C-0112 consisting of an Energy Savings Opportunity Survey (ESOS) performed at Fort Leonard Wood for all buildings listed in Table 1 of this volume and expanded to include the total 275 buildings listed in Table 3.

This report contains recommendations for the reduction of facility energy consumption in accordance with the U.S. Army's directives to produce facilities that operate as energy efficiently as possible while maintaining operational readiness. The survey was performed under the Energy Engineering Analysis Program (EEAP).

The objective of this study is the analysis and recommendations for energy conservation opportunities (ECOs). A summary of the recommended ECOs for all buildings is presented as Table 2 of this volume.

VOLUME LISTING

This report has been divided into 5 separately bound volumes.

A. UNNUMBERED VOLUME

Title: Executive Summary

Contents: Complete Project Summary

B. VOLUME I

Title: Energy Conservation Opportunities (ECOs)

Contents: Executive Summary, Project Narrative, ECO Summaries and Recommendations, Individual building descriptions and building savings summaries.

C. VOLUME II

Title: Calculations

Contents: Evaluation of each ECO/building combination, individual building heating and cooling load calculations and the project contract and meeting minutes.

D. VOLUME III

Title: Site Survey Data

Contents: Data obtained during the site survey and used in the formulation of the project ECOs.

Volume III has limited distribution. Copies have been provided to the DEH and the Kansas City District only.

E. VOLUME IV

Title: Programming Documents

Contents: Programming documents for recommended ECIP, PECIP, QRIP and OSD PIF projects for the installation of qualified ECOs.

PURPOSE

The purpose of this Energy Savings Opportunity Survey (ESOS) is to:

1. Review the previously completed energy studies accomplished for Fort Leonard Wood.

2. Perform a limited site survey, evaluate the facilities with respect to selected Energy Conservation Opportunities (ECOs), and identify any other feasible ECOs for recommendation.

3. Provide programming documentation for projects developed to implement the recommended ECOs.

BRIEF SCOPE OF WORK

The following outline is a brief description of work performed during the preparation of this report. The complete scope of work text as issued by the Corps of Engineers is included in Volume II, Section IX of this report.

1. Review for general information the previously completed Energy Engineering Analysis Program (EEAP) study and all other energy studies which were performed a the Fort Leonard Wood installation.

2. Evaluate selected Energy Conservation Opportunities (ECOs) to determine their energy savings potential and economic feasibility.

3. Perform a limited site survey of selected buildings to insure that any new methods of energy conservation which are practical and have not been evaluated in any previous energy study have been considered and the results documented.

4. Provide complete new programming or implementation documentation for all recommended ECOs.

5. Prepare a comprehensive report to document the project.

PROCEDURE

Initial work on this project began with the entry interview conference held with the U.S. Army Corps of Engineers, Kansas City District and Director of Engineering and Housing at Fort Leonard Wood on December 3, 1985. This meeting along with all subsequent meetings served to clarify and/or amend various items in the Scope of Work and update the Corps with progress reports as the work was completed.

A. FIELD SURVEY

Numerous field visits were made to the Fort Leonard Wood facility during the ensuing 18 months in an effort to gather all information required to ensure adequate evaluation of our energy saving recommendations.

There are a total of 275 buildings included in this report. Many of these buildings are very similar in construction and equipment types.

A limited site survey was conducted to develop savings calculations and recommendations for 61 typical buildings. This survey began with a careful analysis of available construction plans and specifications. Inspections of the buildings were then made, and in addition to the data gathered for specific ECO calculations, the following observations were recorded.

a. Building personnel were interviewed to determine the building operating schedules and current use.

b. The HVAC equipment type, location and general operating condition.

c. Measured amps and voltage on major HVAC equipment including air handlers, pumps and chillers.

B. OFFICE ANALYSIS

After completion of the field survey portion of the project, data was evaluated in our Overland Park, Kansas office to qualify and prioritize ECOs in accordance with ECIP guidelines for the development of projects for funding.

Individual building ECOs were considered based on information obtained during the limited site survey.

ECOs that were considered infeasible were listed in the report with reasons for elimination. ECOs recommended for implementation were described in the report. Cost estimated, energy savings calculations, and economic analysis were prepared and included for each ECO/Building combination.

C. UTILITY COSTS

1. Electricity

The electrical energy cost which was used for energy saving calculations is $20.575/MBTU for Region 7, in accordance with the June 1986 ECIP Guidance.

Based on discussion at the Interim Review Conference, it was decided to use the regional utility prices rather than local prices.

Using the same ratio as Regional average KWH cost to Local KWH cost, an estimated Regional Demand Charge of $9.662/KWH/month has been calculated for use in demand but not energy saving ECOs.

2. LP Gas

Liquid petroleum gas is not addressed in the ECIP guidance manual, so actual local delivered fuel cost of $0.4655/gal was used in the savings calculations. This equals 4.90 $/MBTU at 95,000 BTU/Gallon.

The ECIP natural gas discount factor was used for life cycle cost computations.

3. # 2 Oil

In accordance with ECIP criteria, the Region 7 fuel cost of 6.203 $/MBTU was used for savings calculations. The actual local delivered cost is $0.7798/gal or 5.622 $/MBTU at a fuel value of 138,7000 BTU/gal.

4. # 6 Oil

In accordance with ECIP criteria, the Region 7 fuel cost of 3.490 $/MBTU was used for savings calculations. The actual local delivered cost is $ 0.70/gal or 4.667 $/MBTU at a fuel value of 150,000 BTU/gal.

SUMMARY AND RECOMMENDATIONS

Nineteen recommended ECOs comprise the 8 projects listed on the Project Savings Summary. Project #6 shows no energy savings, the savings from this chilled water storage project is electric demand charge savings. The ECOs recommended are the following:

ECO #	ECO TITLE
1	Insulation, Masonry Walls
1A	Insulation, Metal Roof
1B	Insulation, Metal Walls
2	Weather Stripping & Caulking
7	Reduce DHW Temperature
10	Replace Incandescent Lighting
11X	Exit Sign Replacement
12	High Efficiency Motor Replacement
14	Infrared Heaters
15	Economizer Cycles (Dry Bulb)
16	Control DHW Circulation Pump
18	Decentralize DHW Heaters
21	Reduce Air Flow
23	Install Timeclocks & Night Thermostats
31	Waste Heat Recovery
32	Thermal Storage (Chilled Water)
34	Interlock Kitchen Exhaust & Make-up
35	Fan Controls

ECO #7, Reduce Domestic Hot Water (DHW) temperature has been recommended for several buildings, but may be done by adjustment of controls at minimal cost and is therefore recommended as a low cost project. The results have not been extrapolated to include similar buildings because there is not a good correlation between control adjustment and building size or type. This is an item, like space thermostats, that requires occupant cooperation and discipline to be effective.

ECO #33, Steam trap inspection is recommended as a low cost project to be conducted on a continuing basis by maintenance personnel. The scope of this project is unknown, but the cost benefit ratio can be quite good. (SIR of about 6)

The relative priority of each recommended ECO in ECIP SIR sequence is provided in the following chart.

A breakdown of the savings for each ECO is provided in the second chart which identifies the ECO grouping for the recommended projects.

A copy of the savings summary for each ECO identifying the savings per building and a building list for each ECO have also been included in this section.

FORT LEONARD WOOD

RELATIVE PRIORITY OF ECOs

CONTRACT NO DACA41-85-C-0112

ECO NAME	ECO #	ANNUAL MBTU SAVINGS				ENERGY COST SAVINGS	NON ENERGY SAVINGS	TOTAL ANNUAL SAVINGS	CONST COST	SIMPLE PAYBACK	SIR	PROJECT COST W/ SIOH	FY89 COST W/O SIOH
		#6 OIL	#2 OIL	LP GAS	ELECT								
REDUCE AIR FLOW	21	0.00	0.00	0.00	8,850.47	$182,098	$0	$182,098	$29,927	0.16	52.08	$31,573	$32,276
EXIT LIGHT CONV	11X	0.00	0.00	0.00	3,313.31	$68,174	$1,154	$69,328	$20,768	0.30	36.79	$21,910	$22,398
DRY BULB ECON	15	0.00	0.00	0.00	2,838.68	$58,407	$0	$58,407	$21,780	0.37	22.95	$22,978	$23,489
REDUCE DHW TEMP	7	46.30	11.62	3.90	2.43	$304	$0	$304	$450	1.74	11.04	$475	$485
DHW CIRC PUMP	16	831.08	28.16	102.34	62.13	$4,853	$0	$4,853	$11,396	2.35	6.82	$12,023	$12,290
STEAM TRAP INSP.	33	29.57	0.00	0.00	0.00	$103	$0	$103	$91	0.88	6.81	$96	$98
TIME CLOCKS	23	0.00	1,575.10	318.62	173.30	$14,897	$0	$14,897	$25,332	1.70	6.30	$26,725	$27,320
WASTE HEAT RECOV	31	3,188.36	0.00	0.00	-9.69	$10,931	$0	$10,931	$43,960	4.02	4.41	$46,378	$47,410
METAL WALL INS	1B	0.00	4,804.00	0.00	0.00	$29,800	$0	$29,800	$125,928	4.23	3.95	$132,854	$135,811
VENT FAN CONTROL	35	0.00	0.00	0.00	43.25	$890	$0	$890	$2,107	2.37	3.62	$2,223	$2,272
REPL INCAND LGTS	10	0.00	0.00	0.00	4,826.83	$99,312	$0	$99,312	$308,862	3.11	3.54	$325,849	$333,101
DEDICATED DHW	18	0.00	417.95	0.00	0.00	$2,592	$0	$2,592	$12,952	5.00	3.34	$13,664	$13,968
HI-EFF MOTORS	12	0.00	0.00	0.00	375.07	$7,717	$0	$7,717	$27,351	3.54	3.11	$28,855	$29,498
KITCH VENT CONTRL	34	1,919.30	0.00	0.00	165.09	$10,096	$0	$10,096	$36,034	3.57	3.03	$38,016	$38,862
INFRARED HEATERS	14	0.00	3,699.00	-1,950.00	96.50	$15,375	$0	$15,375	$89,630	5.83	2.46	$94,560	$96,664
WEATHERSTRIP	2	0.00	1,168.61	188.83	40.11	$9,000	$0	$9,000	$40,560	4.51	1.43	$42,791	$43,743
METAL ROOF INS	1A	0.00	8,088.96	0.00	0.00	$50,175	$0	$50,175	$412,280	8.22	1.37	$434,955	$444,636
MASONRY WALL INS	1	13,130.34	647.56	320.90	983.32	$71,645	$0	$71,645	$863,062	12.05	1.31	$910,530	$930,795
CHW STORAGE	32	0.00	0.00	0.00	0.00	$0	$21,403	$21,403	$70,356	3.29	3.52	$74,226	$75,878
GRAND TOTAL		19,144.95	20,440.96	-1,015.41	21,760.80	$636,369	$22,557	$658,926	$2,142,826	3.25		$2,260,681	$2,310,995
		60331.30 TOTAL MBTU SAVED PER YEAR											

EX- 10

Revised 8/14/87

FORT LEONARD WOOD

PROJECT SAVINGS SUMMARY

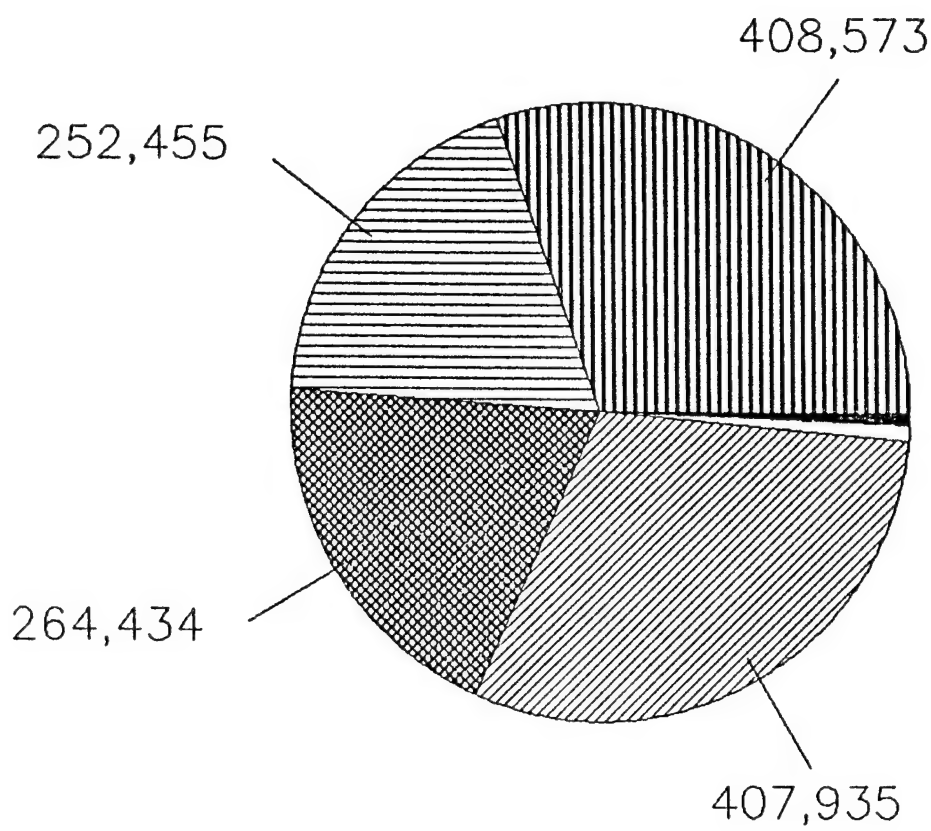
CONTRACT NO DACA41-85-C-0112

ECO NAME / PROJECT # & TYPE	ECO #	ANNUAL MBTU SAVINGS #6 OIL	#2 OIL	LP GAS	ELECT	ENERGY COST SAVINGS	NON ENERGY SAVINGS	TOTAL ANNUAL SAVINGS	CONSTRUCT COST	SIMPLE PAYBACK	SIR	PROJECT COST W/ SIOH	FY89 COST W/O SIOH	FY87 W/ DESIGN & SIOH
METAL WALL INS	1B	0.00	4,804.00	0.00	0.00	$29,800	$0	$29,800	$125,928	4.23	3.95	$132,854	$135,811	$140,410
METAL ROOF INS	1A	0.00	8,088.96	0.00	0.00	$50,175	$0	$50,175	$412,280	8.22	1.37	$434,955	$444,636	$459,692
MASONRY WALL INS	1	13,130.34	647.56	320.90	983.32	$71,645	$0	$71,645	$863,062	12.05	1.31	$910,530	$930,795	$962,314
#1 ECIP		13,130.34	13,540.52	320.90	983.32	$151,620	$0	$151,620	$1,401,270	9.24	1.76	$1,478,340	$1,511,242	$1,562,416
WASTE HEAT RECOV	31	3,188.36	0.00	0.00	-9.69	$10,931	$0	$10,931	$43,960	4.02	4.41	$46,378	$47,410	$49,015
HI-EFF MOTORS	12	0.00	0.00	0.00	375.07	$7,717	$0	$7,717	$27,351	3.54	3.11	$28,855	$29,498	$30,496
#2 PECIP		3,188.36	0.00	0.00	365.38	$18,648	$0	$18,648	$71,311	3.82	3.91	$75,233	$76,907	$79,512
#3 OSD PIF, LIGHTS	10	0.00	0.00	0.00	4,826.83	$99,312	$0	$99,312	$308,862	3.11	3.54	$325,849	$333,101	$344,381
EXIT LIGHT CONV	11X	0.00	0.00	0.00	3,313.31	$68,174	$1,154	$69,328	$20,768	0.30	36.79	$21,910	$22,398	$23,156
DHW CIRC PUMP	16	831.08	28.16	102.34	62.13	$4,853	$0	$4,853	$11,396	2.35	6.82	$12,023	$12,290	$12,707
TIME CLOCKS	23	0.00	1,575.10	318.62	173.30	$14,897	$0	$14,897	$25,332	1.70	6.30	$26,725	$27,320	$28,245
VENT FAN CONTROL	35	0.00	0.00	0.00	43.25	$890	$0	$890	$2,107	2.37	3.62	$2,223	$2,272	$2,349
#4 QRIP		831.08	1,603.26	420.96	3,591.99	$88,814	$1,154	$89,968	$59,603	0.66	18.18	$62,881	$64,281	$66,457
DRY BULB ECON	15	0.00	0.00	0.00	2,838.68	$58,407	$0	$58,407	$21,780	0.37	22.95	$22,978	$23,489	$24,285
REDUCE AIR FLOW	21	0.00	0.00	0.00	8,850.47	$182,098	$0	$182,098	$29,927	0.16	52.08	$31,573	$32,276	$33,369
#5 QRIP		0.00	0.00	0.00	11,689.15	$240,505	$0	$240,505	$51,707	0.21	39.81	$54,551	$55,765	$57,653
#6 PECIP, CHW STORE	32	0.00	0.00	0.00	0.00	$0	$21,403	$21,403	$70,356	3.29	3.52	$74,226	$75,878	$78,447
WEATHERSTRIP	2	0.00	1,168.61	188.83	40.11	$9,000	$0	$9,000	$40,560	4.51	1.43	$42,791	$43,743	$45,224
INFRARED HEATERS	14	0.00	3,699.00	-1,950.00	96.50	$15,375	$0	$15,375	$89,630	5.83	2.46	$94,560	$96,664	$99,937
DEDICATED DHW	18	0.00	417.95	0.00	0.00	$2,592	$0	$2,592	$12,952	5.00	3.34	$13,664	$13,968	$14,441
KITCH VENT CONTRL	34	1,919.30	0.00	0.00	165.09	$10,096	$0	$10,096	$36,034	3.57	3.03	$38,016	$38,862	$40,178
#7 MACOM		1,919.30	5,285.56	-1,761.17	301.70	$37,063	$0	$37,063	$179,176	4.83		$189,031	$193,238	$199,781
REDUCE DHW TEMP	7	46.30	11.62	3.90	2.43	$304	$0	$304	$450	1.74	11.04	$475	$485	$502
STEAM TRAP INSP.	33	29.57	0.00	0.00	0.00	$103	$0	$103	$91	0.88	6.81	$96	$98	$101
#8 LOW/NO COST		75.87	11.62	3.90	2.43	$407	$0	$407	$541	1.33	12.54	$571	$583	$603

BASE WIDE ENERGY CONSUMPTION

FY86

MILLION BTU PER YEAR



#6 OIL

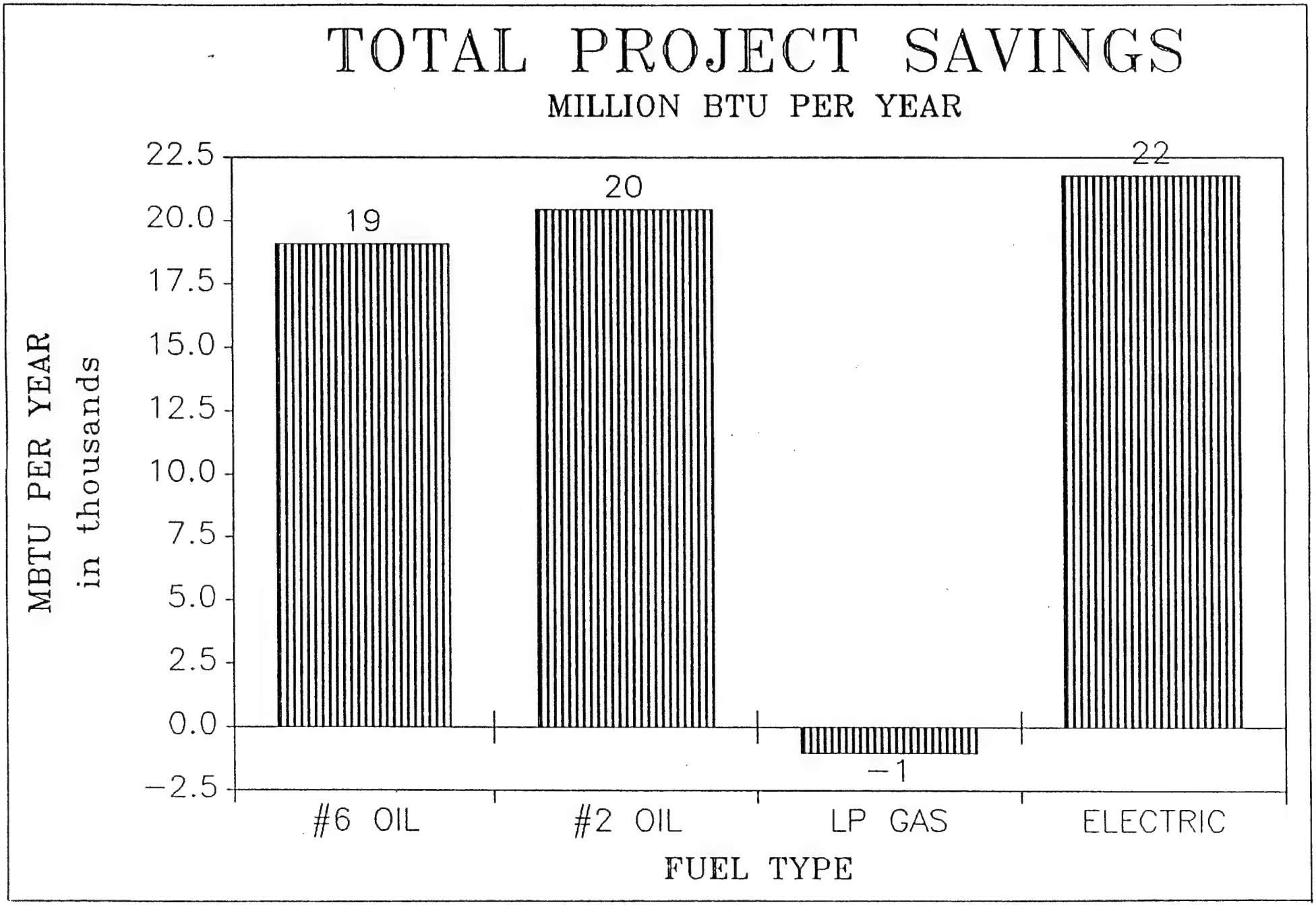
#2 OIL

LP GAS

ELECTRIC

#1 OIL

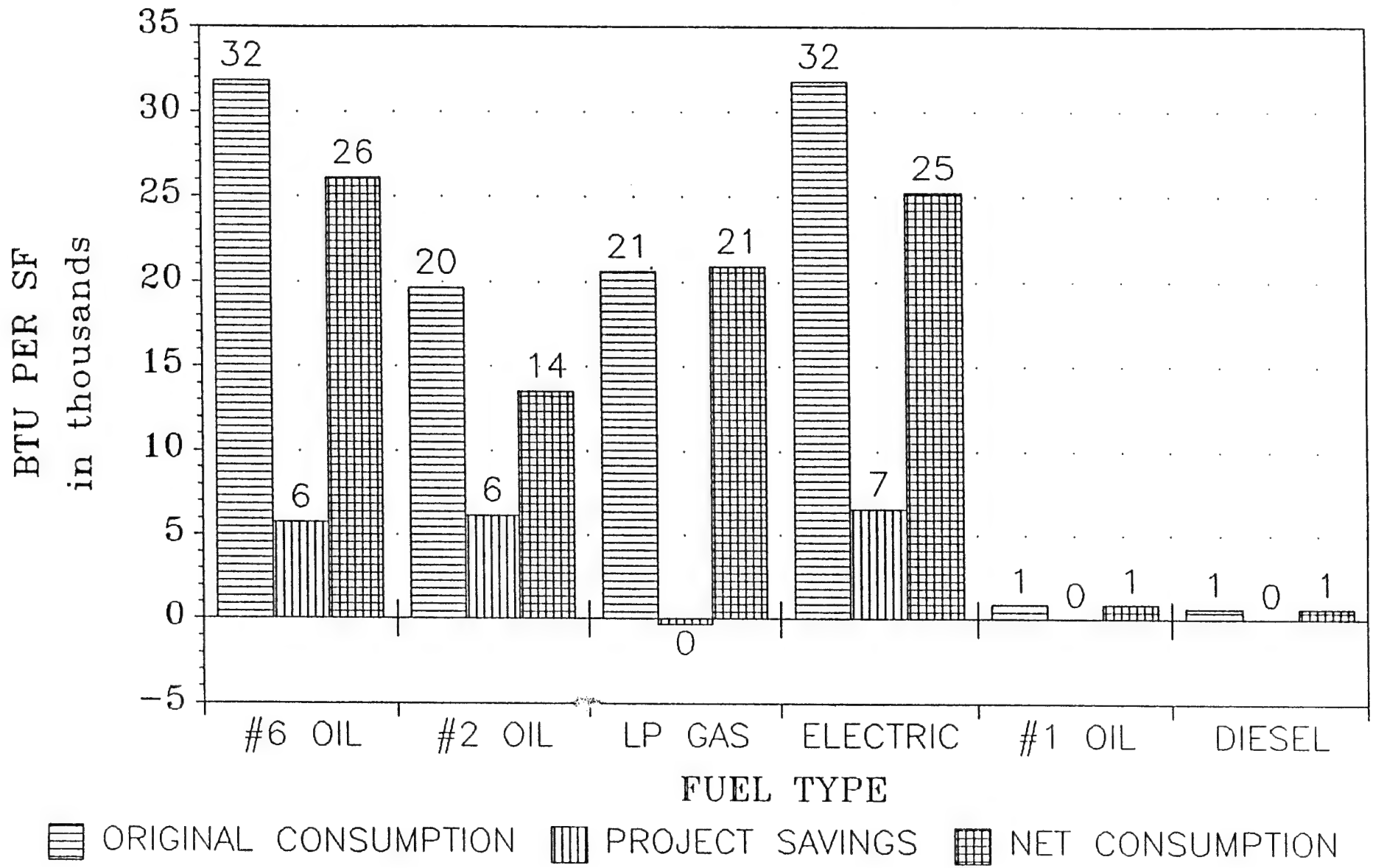
DIESEL


TOTAL PROJECT SAVINGS
MILLION BTU PER YEAR
MBTU PER YEAR
in thousands
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
-2.5
19
20
-1
22
#6 OIL
#2 OIL
LP GAS
ELECTRIC
FUEL TYPE

EX- 12A

EX-12B

NET CONSUMPTION PER SQ FT
KBTU PER SF PER YEAR



ASSUMES TYPICAL CONSUMPTION PER SQ FT

RECOMMENDED PROJECT SUMMARY

PROJECT FUNDING BUILDING	#1 ECIP	#2 PECIP	#3 OSD PIF	#4 QRIP	#5 QRIP	#6 PECIP
185		X	X	X		
312	X		X	X	X	
315	X			X		
318				X		
319				X		
320						
450			X	X		
499	X		X	X	X	X
500			X	X	X	
561	X					
562	X					
563	X					
564	X					
565	X					
565	X		X			
566	X					
567	X					
568	X					
569	X					
625	X		X	X	X	
626	X		X			
627	X		X	X	X	
628	X		X	X	X	
629	X		X	X	X	
630	X	X	X	X	X	
631	X		X	X	X	
633	X		X			
634	X		X	X	X	
635	X		X	X	X	
636	X			X		
638	X		X	X	X	
650	X		X	X	X	
651	X		X	X	X	
652	X		X	X	X	
653	X	X	X	X	X	
654	X		X	X	X	
655	X		X			
656	X		X			
657	X	X	X	X	X	
658	X		X	X	X	
659	X		X	X	X	
660	X		X	X	X	
664	X					
665	X					
666	X					
667	X					
668	X					
669	X					
672			X	X		
673			X	X		
680			X	X		
681			X	X		
686	X					
687	X					
688	X		X			
689	X					
690	X					
691	X					
692	X					
693	X					
694	X					
701	X					
702	X					
703	X		X			

EX Revised 8/14/87

RECOMMENDED PROJECT SUMMARY

PROJECT FUNDING BUILDING	#1 ECIP	#2 PECIP	#3 OSD PIF	#4 QRIP	#5 QRIP	#6 PECIP
704	X					
705	X					
706	X					
707	X					
709	X					
710	X					
711	X					
712	X					
713	X		X			
713	X		X			
714	X					
715	X					
716	X					
717	X					
718	X					
719	X					
720	X					
721	X					
722	X		X			
723	X					
724	X					
725	X					
726	X					
727	X					
728	X					
730	X		X	X	X	
731	X		X	X	X	
732	X		X	X	X	
733	X		X			
734	X		X			
735	X	X	X	X	X	
736	X		X	X	X	
738	X		X	X	X	
739	X	X	X	X	X	
740	X		X	X	X	
741	X		X	X		
743	X		X	X	X	
747	X			X		
748	X		X	X	X	
749	X	X	X	X	X	
750	X		X	X	X	
751	X		X			
752	X		X			
753	X		X	X	X	
754	X	X	X	X	X	
755	X		X	X	X	
756	X		X	X	X	
758	X					
759	X					
760	X		X			
761	X					
762	X					
763	X					
764	X					
765	X					
766	X					
772			X	X		
773			X	X		
780			X	X		
781			X	X		
790	X					
791	X					
792	X		X			
793	X					

RECOMMENDED PROJECT SUMMARY

PROJECT FUNDING BUILDING	#1 ECIP	#2 PECIP	#3 OSD PIF	#4 QRIP	#5 QRIP	#6 PECIP
794	X					
795	X					
796	X					
797	X					
798	X					
801						
806	X					
807	X					
808	X					
809	X					
810	X					
811	X		X			
812	X					
813	X					
814	X					
815	X		X	X	X	
816	X		X	X	X	
817	X		X	X	X	
818	X			X		
819	X		X	X	X	
820	X		X	X	X	
821	X	X	X	X	X	
822	X	X	X	X	X	
823	X		X			
824	X		X			
825	X		X	X	X	
827	X		X	X	X	
828	X		X	X	X	
829	X		X	X	X	
830	X		X	X	X	
831	X		X	X	X	
832	X		X	X	X	
836	X	X	X	X	X	
838	X		X	X	X	
840	X		X			
841	X		X			
842	X		X	X	X	
851	X					
852	X					
853	X		X			
854	X					
855	X					
856	X					
857	X					
858	X					
859	X					
990			X	X		
991			X	X		
998			X	X		
999			X	X		
1006	X		X			
1007	X		X			
1008	X		X	X	X	
1009	X		X	X	X	
1010	X	X	X	X	X	
1011	X	X	X	X	X	
1012	X			X		
1013	X			X		
1014	X			X		
1015	X			X		
1016	X			X		
1018	X		X	X	X	
1025	X		X			
1028	X			X		

EX

Revised 8/14/87

RECOMMENDED PROJECT SUMMARY

PROJECT FUNDING BUILDING	#1 ECIP	#2 PECIP	#3 OSD PIF	#4 QRIP	#5 QRIP	#6 PECIP
1029	X			X		
1601	X	X	X			
1608			X	X	X	
1700				X		
1701				X		
1702				X		
1703				X	X	
1704				X	X	
1705				X	X	
1706				X		
1707				X		
1720			X	X		
1722			X	X		
1723			X	X		
1724			X	X		
1725			X	X		
1726			X	X		
1728			X	X		
1729			X	X		
1730			X	X		
1731			X	X		
1732			X	X		
1733			X	X		
1734			X	X		
1735			X	X		
1740		X		X	X	
1750		X		X	X	
1761			X	X		
1762			X	X		
1763			X	X		
1764			X	X		
1765			X	X		
1766			X	X		
1767			X	X		
1768			X	X		
1769			X	X		
1771			X	X		
1773			X	X		
1774			X	X		
1775			X	X		
1776			X	X		
2240				X		
2250						
2317						
2347						
2348						
2395						
2399			X		X	
4100	X			X		
4101	X			X		
4102	X			X		
4103	X			X		
4104	X			X		
4110				X		
4111				X		
4112				X		
4113				X		
4114				X		
4115				X		
5050			X	X		
5052				X		
5053			X	X		
5074				X	X	
5122						

EX Revised 8/14/87

RECOMMENDED PROJECT SUMMARY

PROJECT FUNDING BUILDING	#1 ECIP	#2 PECIP	#3 OSD PIF	#4 QRIP	#5 QRIP	#6 PECIP
5130						
5150				X		
5161				X		
5169				X		
5231				X		
5301				X		
5334				X		
5346				X		
5350				X		
5361				X		
5374				X		
5391				X		
5500				X		
5511				X		
5531				X		
5592				X		
5702				X		
5732				X		
5743				X		
10250		X				

ECO #1: Insulation, Masonry Walls

CURRENT SITUATION: (Permanent Buildings)

A. Roof / Ceiling Insulation
The buildings inspected do not have attic spaces where insulation may easily be added. Roof insulation should be considered when the buildings are re-roofed.

B. Wall Insulation
The permanent buildings inspected have double masonry cavity walls without insulation.

These walls may be insulated by drilling holes in the wall and blowing insulation into the cavity. This has been considered for most buildings.

C. Basement Insulation
These cast-in-place concrete walled areas may only be insulated by adding a new interior or exterior wall surface. This was estimated to cost more than $3.50 per square foot. Insulating these areas was not considered because the basement are generally unoccupied and this would have to be justified based upon comfort because of the long payback.

PROPOSAL:

Install blown in wall insulation in feasible areas where none exists. Expansion of this project to include permanent buildings not in this ESOS should be considered.

ECONOMICS:

The total cost, savings, Savings Investment Ratio (SIR) and simple payback are:

Heating Energy Savings Per Year: 14,099 MBTU	$ 51,415
Electricity Savings Per Year: 983 MBTU	$ 20,231
Total Savings Per Year:	$ 71,646
Total Construction Cost:	$ 863,062
Simple Payback (YRS):	12.05
SIR:	1.31

ENERGY SAVING OPPORTUNITY STUDY

INDIVIDUAL ENERGY CONSERVATION OPPORTUNITY SAVINGS SUMMARY

ECO NUMBER: 1
INSULATE EXTERIOR WALLS

ECO LIFE: 25 YEARS

BUILDING NUMBER	SIM BLDG	***** MBTU SAVINGS PER YEAR ******* #6 OIL	#2 OIL	LP GAS	ELECT	FUEL SAVINGS	OTHER SAVING	PROJECT COST	SIMPLE PAYBACK	SIR	
499	0	0.00	72.50	0.00	8.68	$628	0	$4,247	6.76	2.23	1R
315	0	0.00	0.00	320.90	30.18	$2193	0	$18,799	8.57	1.98	
1601	0	0.00	133.71	0.00	0.00	$829	0	$7,833	9.45	1.77	
4102	0	0.00	67.83	0.00	8.70	$600	0	$5,557	9.26	1.62	
4102	4	0.00	271.32	0.00	34.80	$2399	0	$22,228	9.27	1.62	
743	0	46.99	0.00	0.00	5.78	$283	0	$2,831	10.00	1.48	
743	3	140.97	0.00	0.00	17.35	$849	0	$8,493	10.00	1.48	
821	0	81.11	0.00	0.00	8.70	$462	0	$4,887	10.58	1.42	
636	0	62.63	0.00	0.00	6.06	$343	0	$3,774	11.00	1.38	
734	0	136.26	0.00	0.00	13.18	$747	0	$8,210	10.99	1.38	
740	0	8.60	0.00	0.00	0.83	$47	0	$518	11.02	1.38	
740	11	94.60	0.00	0.00	9.16	$519	0	$5,698	10.98	1.38	
741	0	62.63	0.00	0.00	6.06	$343	0	$3,774	11.00	1.38	
822	0	8.60	0.00	0.00	0.83	$47	0	$518	11.02	1.38	
823	0	136.26	0.00	0.00	13.18	$747	0	$8,210	10.99	1.38	
628	0	271.73	0.00	0.00	21.51	$1391	0	$16,374	11.77	1.32	
628	25	6793.25	0.00	0.00	537.69	$34771	0	$409,350	11.77	1.32	
657	0	81.11	0.00	0.00	6.42	$415	0	$4,887	11.78	1.32	
657	7	567.77	0.00	0.00	44.94	$2906	0	$34,209	11.77	1.32	
735	0	81.11	0.00	0.00	6.42	$415	0	$4,887	11.78	1.32	
1008	0	41.37	0.00	0.00	3.27	$212	0	$2,493	11.76	1.32	
1014	0	295.22	0.00	0.00	23.37	$1511	0	$17,789	11.77	1.32	
1014	5	1476.10	0.00	0.00	116.84	$7556	0	$88,945	11.77	1.32	
1016	0	295.22	0.00	0.00	23.37	$1511	0	$17,789	11.77	1.32	
1006	0	122.63	0.00	0.00	10.79	$650	0	$8,210	12.63	1.22	
1010	0	73.80	0.00	0.00	6.49	$391	0	$4,941	12.64	1.22	
1010	1	73.80	0.00	0.00	6.49	$391	0	$4,941	12.64	1.22	
312	0	0.00	102.20	0.00	12.23	$886	0	$11,402	12.87	1.17	
655	0	136.26	0.00	0.00	0.00	$476	0	$8,210	17.25	1.02	
655	11	1498.86	0.00	0.00	0.00	$5231	0	$90,310	17.26	1.02	
747	0	271.73	0.00	0.00	0.00	$948	0	$16,374	17.27	1.02	
818	0	271.73	0.00	0.00	0.00	$948	0	$16,374	17.27	1.02	
	Total	13130.34	647.56	320.90	983.32	$71645	0	$863,062	12.05	1.31	
1700	0	203.08	0.00	0.00	0.00	$709	0	$13,803	19.47	0.90	N

Note: Factor Electric MBTU/Yr Savings from calculation work sheets by (3,413 Site ÷ 11,600 Source BTU/KWH) to equal the Site MBTU/Yr savings on this summary page and on the LCCA pages.

ECO 1 BUILDING LIST

312 , 315 , 499 , 625 , 626 , 627 , 628 , 629 ,
630 , 631 , 633 , 634 , 635 , 636 , 638 , 650 ,
651 , 652 , 653 , 654 , 655 , 656 , 657 , 658 ,
659 , 660 , 730 , 731 , 732 , 733 , 734 , 735 ,
736 , 738 , 739 , 740 , 741 , 743 , 747 , 748 ,
749 , 750 , 751 , 752 , 753 , 754 , 755 , 756 ,
815 , 816 , 817 , 818 , 819 , 820 , 821 , 822 ,
823 , 824 , 825 , 827 , 828 , 829 , 830 , 831 ,
832 , 836 , 838 , 840 , 841 , 842 , 1006 , 1007 ,
1008 , 1009 , 1010 , 1011 , 1012 , 1013 , 1014 , 1015 ,
1016 , 1018 , 1025 , 1028 , 1029 , 1601 , 4100 , 4101 ,
4102 , 4103 , 4104

ECO #1A: Insulation, Metal Roof

CURRENT SITUATION: (Permanent Buildings)

The pre-engineered metal buildings used for barracks and latrines have minimal insulation. Systems are commercially available to add insulation to these structures without disruption of the exterior weathering membrane.

The typical buildings (#562 and 565) are used only in summer and are not air conditioned. These buildings consume no heating and cooling energy, they do have exhaust fans for summer ventilation.

Our savings calculations assume that the heating plants are recommissioned and the buildings are used year round. Use of the buildings will actually increase energy consumption but this ECO will reduce that increase.

PROPOSAL:

Re-insulate the roof by suspending a new R19 insulation system beneath the roof purlins. A system comparable to Heat Flow Shield, manufactured by Construction Plastics, has been used for savings calculations.

ECONOMICS:

The total cost, savings, Savings Investment Ratio (SIR) and simple payback are:

Heating Energy Savings Per Year: 8,089 MBTU	$ 50,175
Total Construction Cost:	$ 412,280
Simple Payback (YRS):	8.22
SIR:	1.37

ENERGY SAVING OPPORTUNITY STUDY

INDIVIDUAL ENERGY CONSERVATION OPPORTUNITY SAVINGS SUMMARY

ECO NUMBER: 1A

REINSULATE METAL ROOF

ECO LIFE: 15 YEARS

BUILDING NUMBER	SIM BLDG	***** MBTU SAVINGS PER YEAR ******* #6 OIL	#2 OIL	LP GAS	ELECT	FUEL SAVINGS	OTHER SAVING	PROJECT COST	SIMPLE PAYBACK	SIR	
562	0	0.00	91.92	0.00	0.00	$570	0	$4,685	8.22	1.37	1R
562	78	0.00	7169.76	0.00	0.00	$44474	0	$365,430	8.22	1.37	
565	0	0.00	91.92	0.00	0.00	$570	0	$4,685	8.22	1.37	
565	8	0.00	735.36	0.00	0.00	$4561	0	$37,480	8.22	1.37	
	Total	0.00	8088.96	0.00	0.00	$50175	0	$412,280	8.22	1.37	

ECO 1A BUILDING LIST

561 , 562 , 563 , 564 , 565 , 565 , 566 , 567 ,
568 , 569 , 664 , 665 , 666 , 667 , 668 , 669 ,
686 , 687 , 688 , 689 , 690 , 691 , 692 , 693 ,
694 , 701 , 702 , 703 , 704 , 705 , 706 , 707 ,
709 , 710 , 711 , 712 , 713 , 714 , 715 , 716 ,
717 , 718 , 719 , 720 , 721 , 722 , 723 , 724 ,
725 , 726 , 727 , 728 , 758 , 759 , 760 , 761 ,
762 , 763 , 764 , 765 , 766 , 790 , 791 , 792 ,
793 , 794 , 795 , 796 , 797 , 798 , 806 , 807 ,
808 , 809 , 810 , 811 , 812 , 813 , 814 , 851 ,
852 , 853 , 854 , 855 , 856 , 857 , 858 , 859

ECO #1B: Insulation, Metal Walls

CURRENT SITUATION: (Permanent Buildings)

As have the metal building roofs, the metal building walls have been installed with minimal (1 1/2") insulation.

The typical buildings (#562 and 565) are used only in summer and are not air conditioned. These buildings consume no heating and cooling energy, they do have exhaust fans for summer ventilation.

PROPOSAL:

Fill the cavity between the exterior wall panels and the interior liner panels with insulation. This may be done with either blown-in insulation thru drilled then capped holes, or batt insulation installed by removal and replacement of wall panels.

ECONOMICS:

The total cost, savings, Savings Investment Ratio (SIR) and simple payback are:

Heating Energy Savings Per Year: 4,804 MBTU	$ 29,800
Total Construction Cost:	$ 125,928
Simple Payback (YRS):	4.23
SIR:	3.95

ENERGY SAVING OPPORTUNITY STUDY

INDIVIDUAL ENERGY CONSERVATION OPPORTUNITY SAVINGS SUMMARY

ECO NUMBER: 18

INSULATE METAL WALLS

ECO LIFE: 25 YEARS

BUILDING NUMBER	SIM BLDG	***** MBTU SAVINGS PER YEAR ******* #6 OIL	#2 OIL	LP GAS	ELECT	FUEL SAVINGS	OTHER SAVING	PROJECT COST	SIMPLE PAYBACK	SIR
562	0	0.00	54.60	0.00	0.00	$339	0	$1,431	4.22	3.95
562	78	0.00	4258.80	0.00	0.00	$26417	0	$111,618	4.23	3.95
565	0	0.00	54.60	0.00	0.00	$339	0	$1,431	4.22	3.95
565	8	0.00	436.00	0.00	0.00	$2705	0	$11,448	4.23	3.95
	Total	0.00	4804.00	0.00	0.00	$29800	0	$125,928	4.23	3.95

Note: Factor Electric MBTU/Yr Savings from calculation work sheets by (3,413 Site ÷ 11,600 Source BTU/KWH) to equal the Site MBTU/Yr savings on this summary page and on the LCCA pages.

ECO 1B BUILDING LIST

561 , 562 , 563 , 564 , 565 , 565 , 566 , 567 ,
568 , 569 , 664 , 665 , 666 , 667 , 668 , 669 ,
686 , 687 , 688 , 689 , 690 , 691 , 692 , 693 ,
694 , 701 , 702 , 703 , 704 , 705 , 706 , 707 ,
709 , 710 , 711 , 712 , 713 , 714 , 715 , 716 ,
717 , 718 , 719 , 720 , 721 , 722 , 723 , 724 ,
725 , 726 , 727 , 728 , 758 , 759 , 760 , 761 ,
762 , 763 , 764 , 765 , 766 , 790 , 791 , 792 ,
793 , 794 , 795 , 796 , 797 , 798 , 806 , 807 ,
808 , 809 , 810 , 811 , 812 , 813 , 814 , 851 ,
852 , 853 , 854 , 855 , 856 , 857 , 858 , 859

ECO #2: Weather Stripping and Caulking

CURRENT SITUATION:

A. Window Weather Stripping

The majority of the windows have recently been replaced and are in good condition. Those that are in poor condition are generally in areas where reduced infiltration around the casement will have minimal effect on energy consumption, ie., bay areas with large overheat doors.

B. Door Weather Stripping

Our observations revealed that most of the door weather stripping was in poor condition or non-existent.

PROPOSAL:

Replace or install new door weather stripping in areas where the stripping is in poor condition and or non-existent. It is also recommended to caulk all exterior JAMB casings.

ECONOMICS:

The total cost, savings, Savings Investment Ratio (SIR) and simple payback are:

Heating Energy Savings Per Year: 1357 MBTU	$ 8,175
Electricity Savings Per Year: 40 MBTU	$ 825
Total Savings Per Year:	$ 9,000
Total Construction Cost:	$ 40,560
Simple Payback (YRS):	$ 4.51
SIR:	1.43

ENERGY SAVING OPPORTUNITY STUDY

INDIVIDUAL ENERGY CONSERVATION OPPORTUNITY SAVINGS SUMMARY

ECO NUMBER: 2

WEATHER STRIP & CAULK

ECO LIFE: 8 YEARS

BUILDING NUMBER	SIM BLDG	***** MBTU SAVINGS PER YEAR ******* #6 OIL	#2 OIL	LP GAS	ELECT	FUEL SAVINGS	OTHER SAVING	PROJECT COST	SIMPLE PAYBACK	SIR	
1700	0	0.00	0.00	0.00	40.11	$825	0	$1,680	2.04	2.83	2R
318	0	0.00	13.03	0.00	0.00	$81	0	$360	4.44	1.45	
319	0	0.00	13.03	0.00	0.00	$81	0	$360	4.44	1.45	
450	0	0.00	47.79	0.00	0.00	$296	0	$1,320	4.46	1.45	
499	0	0.00	78.21	0.00	0.00	$485	0	$2,160	4.45	1.45	
562	0	0.00	8.69	0.00	0.00	$54	0	$240	4.44	1.45	
562	78	0.00	677.82	0.00	0.00	$4205	0	$18,720	4.45	1.45	
565	0	0.00	13.03	0.00	0.00	$81	0	$360	4.44	1.45	
565	8	0.00	104.24	0.00	0.00	$647	0	$2,880	4.45	1.45	
2399	0	0.00	24.21	0.00	0.00	$150	0	$720	4.80	1.35	
4102	0	0.00	20.17	0.00	0.00	$125	0	$600	4.80	1.35	
4102	4	0.00	80.68	0.00	0.00	$500	0	$2,400	4.80	1.35	
5074	0	0.00	27.46	0.00	0.00	$170	0	$840	4.94	1.31	
312	0	0.00	33.89	0.00	0.00	$210	0	$1,080	5.14	1.26	
1601	0	0.00	26.36	0.00	0.00	$164	0	$840	5.12	1.26	
2395	0	0.00	0.00	8.07	0.00	$40	0	$240	6.00	1.16	
5150	0	0.00	0.00	60.26	0.00	$295	0	$1,920	6.51	1.09	
315	0	0.00	0.00	15.06	0.00	$74	0	$480	6.49	1.08	
5050	0	0.00	0.00	22.59	0.00	$111	0	$720	6.49	1.08	
5052	0	0.00	0.00	45.19	0.00	$221	0	$1,440	6.52	1.08	
5053	0	0.00	0.00	37.66	0.00	$185	0	$1,200	6.49	1.08	
	Total	0.00	1168.61	188.83	40.11	$9000	0	$40,560	4.51	1.43	

Note: Factor Electric MBTU/Yr Savings from calculation work sheets by (3,413 Site ÷ 11,600 Source BTU/KWH) to equal the Site MBTU/Yr savings on this summary page and on the LCCA pages.

ECO 2 BUILDING LIST

312 ,	315 ,	318 ,	319 ,	450 ,	499 ,	561 ,	562 ,
563 ,	564 ,	565 ,	565 ,	566 ,	567 ,	568 ,	569 ,
664 ,	665 ,	666 ,	667 ,	668 ,	669 ,	686 ,	687 ,
688 ,	689 ,	690 ,	691 ,	692 ,	693 ,	694 ,	701 ,
702 ,	703 ,	704 ,	705 ,	706 ,	707 ,	709 ,	710 ,
711 ,	712 ,	713 ,	713 ,	714 ,	715 ,	716 ,	717 ,
718 ,	719 ,	720 ,	721 ,	722 ,	723 ,	724 ,	725 ,
726 ,	727 ,	728 ,	758 ,	759 ,	760 ,	761 ,	762 ,
763 ,	764 ,	765 ,	766 ,	790 ,	791 ,	792 ,	793 ,
794 ,	795 ,	796 ,	797 ,	798 ,	806 ,	807 ,	808 ,
809 ,	810 ,	811 ,	812 ,	813 ,	814 ,	851 ,	852 ,
853 ,	854 ,	855 ,	856 ,	857 ,	858 ,	859 ,	1601 ,
1700 ,	2395 ,	2399 ,	4100 ,	4101 ,	4102 ,	4103 ,	4104 ,
5050 ,	5052 ,	5053 ,	5074 ,	5150			

ECO #10: Replace Incandescent Lamps with Fluorescent

CURRENT SITUATION:

Incandescent lamps are in use in many locations throughout the fort. Particulary prevalent are recessed "can" fixtures. New twin tube fluorescent lamps with in-line ballast, reflector and lens are made to replace 75 or 150 watt flood lamps.

PROPOSAL:

Replace incandescent lamps with twin tube PL type or other appropriate fluorescent fixture.

ECONOMICS:

The total cost, savings, Savings Investment Ratio (SIR) and simple payback are:

Heating Energy Savings Per Year: N/A MBTU	$	N / A
Electricity Savings Per Year: 4827 MBTU	$	99,312
Total Savings Per Year:	$	99,312
Total Construction Cost:	$	308,862
Simple Payback (YRS):		3.11
SIR:		3.54

ENERGY SAVING OPPORTUNITY STUDY

INDIVIDUAL ENERGY CONSERVATION OPPORTUNITY SAVINGS SUMMARY

ECO NUMBER: 10

REPLACE INCAN. LIGHTING

ECO LIFE: 25 YEARS

BUILDING NUMBER	SIM BLDG	***** MBTU SAVINGS PER YEAR ******* #6 OIL	#2 OIL	LP GAS	ELECT	FUEL SAVINGS	OTHER SAVING	PROJECT COST	SIMPLE PAYBACK	SIR	
672	0	0.00	0.00	0.00	35.50	$730	0	$380	0.52	21.16	*R
672	10	0.00	0.00	0.00	354.95	$7303	0	$3,800	0.52	21.16	
780	0	0.00	0.00	0.00	35.50	$730	0	$380	0.52	21.16	
1601	0	0.00	0.00	0.00	60.06	$1236	0	$1,140	0.92	11.94	
821	0	0.00	0.00	0.00	58.68	$1207	0	$1,890	1.57	7.03	
5050	0	0.00	0.00	0.00	2.15	$44	0	$71	1.61	6.85	
499	0	0.00	0.00	0.00	16.77	$345	0	$641	1.86	5.93	
565	0	0.00	0.00	0.00	26.72	$550	0	$1,140	2.07	5.31	
565	8	0.00	0.00	0.00	213.72	$4397	0	$9,120	2.07	5.31	
735	0	0.00	0.00	0.00	0.81	$17	0	$36	2.12	5.07	
500	0	0.00	0.00	0.00	19.42	$400	0	$891	2.23	4.94	
657	0	0.00	0.00	0.00	18.64	$384	0	$933	2.43	4.53	
657	7	0.00	0.00	0.00	130.45	$2684	0	$6,528	2.43	4.53	
743	0	0.00	0.00	0.00	7.83	$161	0	$401	2.49	4.42	
743	3	0.00	0.00	0.00	23.48	$483	0	$1,202	2.49	4.42	
312	0	0.00	0.00	0.00	111.23	$2289	0	$6,153	2.69	4.10	
1010	0	0.00	0.00	0.00	34.11	$702	0	$1,961	2.79	3.94	
1010	1	0.00	0.00	0.00	34.11	$702	0	$1,961	2.79	3.94	
741	0	0.00	0.00	0.00	7.83	$161	0	$475	2.95	3.73	
2399	0	0.00	0.00	0.00	0.37	$8	0	$23	2.88	3.68	
1608	0	0.00	0.00	0.00	0.37	$8	0	$162	20.25	3.65	
5053	0	0.00	0.00	0.00	1.49	$31	0	$93	3.00	3.63	
734	0	0.00	0.00	0.00	56.64	$1165	0	$3,615	3.10	3.55	
823	0	0.00	0.00	0.00	49.80	$1025	0	$3,271	3.19	3.45	
1720	0	0.00	0.00	0.00	114.61	$2358	0	$7,656	3.25	3.39	
1720	10	0.00	0.00	0.00	1146.06	$23580	0	$76,560	3.25	3.39	
1724	0	0.00	0.00	0.00	55.72	$1146	0	$3,724	3.25	3.39	
1724	14	0.00	0.00	0.00	780.04	$16049	0	$52,135	3.25	3.39	
1766	0	0.00	0.00	0.00	55.72	$1146	0	$3,724	3.25	3.39	
1769	0	0.00	0.00	0.00	114.61	$2358	0	$7,656	3.25	3.39	
655	0	0.00	0.00	0.00	45.54	$937	0	$3,109	3.32	3.32	
655	11	0.00	0.00	0.00	500.97	$10307	0	$34,203	3.32	3.32	
450	0	0.00	0.00	0.00	13.42	$276	0	$925	3.35	3.29	
822	0	0.00	0.00	0.00	5.96	$123	0	$420	3.41	3.22	
1006	0	0.00	0.00	0.00	28.47	$586	0	$2,019	3.45	3.19	
185	0	0.00	0.00	0.00	3.41	$70	0	$278	3.97	2.78	
1008	0	0.00	0.00	0.00	5.03	$103	0	$518	5.03	2.20	
628	0	0.00	0.00	0.00	24.91	$513	0	$2,637	5.14	2.14	
628	25	0.00	0.00	0.00	622.80	$12814	0	$65,920	5.14	2.14	
740	0	0.00	0.00	0.00	0.74	$15	0	$93	6.20	1.81	
740	11	0.00	0.00	0.00	8.19	$169	0	$1,018	6.02	1.81	
	Total	0.00	0.00	0.00	4826.83	$99312	0	$308,862	3.11	3.54	

Note: Factor Electric MBTU/Yr Savings from calculation work sheets by (3,413 Site + 11,600 Source BTU/KWH) to equal the Site MBTU/Yr savings on this summary page and on the LCCA pages.

ECO 10 BUILDING LIST

185 , 312 , 450 , 499 , 500 , 565 , 625 , 626 ,
627 , 628 , 629 , 630 , 631 , 633 , 634 , 635 ,
638 , 650 , 651 , 652 , 653 , 654 , 655 , 656 ,
657 , 658 , 659 , 660 , 672 , 673 , 680 , 681 ,
688 , 703 , 713 , 722 , 730 , 731 , 732 , 733 ,
734 , 735 , 736 , 738 , 739 , 740 , 741 , 743 ,
748 , 749 , 750 , 751 , 752 , 753 , 754 , 755 ,
756 , 760 , 772 , 773 , 780 , 781 , 792 , 811 ,
815 , 816 , 817 , 819 , 820 , 821 , 822 , 823 ,
824 , 825 , 827 , 828 , 829 , 830 , 831 , 832 ,
836 , 838 , 840 , 841 , 842 , 853 , 990 , 991 ,
998 , 999 , 1006 , 1007 , 1008 , 1009 , 1010 , 1011 ,
1018 , 1025 , 1601 , 1608 , 1720 , 1722 , 1723 , 1724 ,
1725 , 1726 , 1728 , 1729 , 1730 , 1731 , 1732 , 1733 ,
1734 , 1735 , 1761 , 1762 , 1763 , 1764 , 1765 , 1766 ,
1767 , 1768 , 1769 , 1771 , 1773 , 1774 , 1775 , 1776 ,
2399 , 5050 , 5053

ECO #11 x : Use more efficient exit lighting

CURRENT SITUATION:

Most exit signs are illuminated by incandescent lamps.

Replacement of existing incandescent exit fixture with self illuminating tritium powered signs will eliminate the use of purchased energy for exit sign, but at great initial cost.

Conversion of the existing signs to fluorescent lamps will save 75% as much energy at 11% of the cost.

PROPOSAL:

Relamp "Exit" signs that have incandescent illumination with fluorescent twin tube lamps and ballast.

ECONOMICS:

The "per fixture" cost, savings, Savings Investment Ratio (SIR) and simple payback are:

Electricity Savings Per Year: 3313 MBTU	$ 68,174
Maintenance Savings Per Year:	$ 1,154
Total Savings Per Year:	$ 69,324
Total Construction Cost:	$ 20,768
Simple Payback (YRS):	0.30
SIR:	36.79

Cost estimate by Overland Park, Kansas
Lighting Contractor, Fuel Economy Labs

ENERGY SAVING OPPORTUNITY STUDY

INDIVIDUAL ENERGY CONSERVATION OPPORTUNITY SAVINGS SUMMARY

ECO NUMBER: 11X

EXIT LIGHT REPLACEMENT

ECO LIFE: 25 YEARS

BUILDING NUMBER	SIM BLDG	***** MBTU SAVINGS PER YEAR ******* #6 OIL	#2 OIL	LP GAS	ELECT	FUEL SAVINGS	OTHER SAVING	PROJECT COST	SIMPLE PAYBACK	SIR	
450	0	0.00	0.00	0.00	19.86	$409	5	$91	0.22	50.08	*R
312	0	0.00	0.00	0.00	28.68	$590	9	$159	0.27	41.50	
628	0	0.00	0.00	0.00	48.44	$997	15	$272	0.27	40.99	
628	25	0.00	0.00	0.00	1211.00	$24916	375	$6,800	0.27	40.99	
499	0	0.00	0.00	0.00	7.90	$163	3	$45	0.27	40.42	
743	0	0.00	0.00	0.00	7.90	$163	3	$45	0.27	40.42	
743	3	0.00	0.00	0.00	23.70	$488	8	$135	0.27	40.42	
315	0	0.00	0.00	0.00	75.09	$1545	24	$431	0.27	40.11	
821	0	0.00	0.00	0.00	27.67	$569	9	$159	0.28	40.07	
747	0	0.00	0.00	0.00	71.14	$1464	23	$409	0.28	40.05	
818	0	0.00	0.00	0.00	71.14	$1464	23	$409	0.28	40.05	
1014	0	0.00	0.00	0.00	71.14	$1464	23	$409	0.28	40.05	
1014	5	0.00	0.00	0.00	355.70	$7319	113	$2,045	0.28	40.05	
1016	0	0.00	0.00	0.00	71.14	$1464	23	$409	0.28	40.05	
636	0	0.00	0.00	0.00	15.81	$325	5	$91	0.28	40.00	
740	0	0.00	0.00	0.00	15.81	$325	5	$91	0.28	40.00	
740	11	0.00	0.00	0.00	173.91	$3578	55	$1,001	0.28	40.00	
741	0	0.00	0.00	0.00	15.81	$325	5	$91	0.28	40.00	
822	0	0.00	0.00	0.00	15.81	$325	5	$91	0.28	40.00	
1008	0	0.00	0.00	0.00	15.81	$325	5	$91	0.28	40.00	
185	0	0.00	0.00	0.00	5.88	$121	3	$45	0.36	30.75	
1705	0	0.00	0.00	0.00	8.82	$181	4	$68	0.37	30.03	
5231	0	0.00	0.00	0.00	8.82	$181	4	$68	0.37	30.03	
5231	16	0.00	0.00	0.00	141.12	$2904	64	$1,088	0.37	30.03	
1703	0	0.00	0.00	0.00	35.27	$726	15	$272	0.37	30.02	
1703	1	0.00	0.00	0.00	35.27	$726	15	$272	0.37	30.02	
1750	0	0.00	0.00	0.00	35.27	$726	15	$272	0.37	30.02	
1750	1	0.00	0.00	0.00	35.27	$726	15	$272	0.37	30.02	
5052	0	0.00	0.00	0.00	35.27	$726	15	$272	0.37	30.02	
1608	0	0.00	0.00	0.00	17.63	$363	8	$136	0.37	30.01	
1700	0	0.00	0.00	0.00	17.63	$363	8	$136	0.37	30.01	
1701	0	0.00	0.00	0.00	29.39	$605	13	$227	0.37	29.97	
1701	3	0.00	0.00	0.00	88.17	$1814	38	$681	0.37	29.97	
5053	0	0.00	0.00	0.00	29.39	$605	13	$227	0.37	29.97	

Note: Electric MBTU/Yr Savings from calculation work sheets have been calculated with 3,413 Site BTU/KWH.

ENERGY SAVING OPPORTUNITY STUDY

BUILDING NUMBER	SIM BLDG	***** MBTU SAVINGS PER YEAR ******* #6 OIL	#2 OIL	LP GAS	ELECT	FUEL SAVINGS	OTHER SAVING	PROJECT COST	SIMPLE PAYBACK	SIR
657	0	0.00	0.00	0.00	20.57	$423	9	$159	0.37	29.95
657	7	0.00	0.00	0.00	143.99	$2963	61	$1,113	0.37	29.95
735	0	0.00	0.00	0.00	20.57	$423	9	$159	0.37	29.95
5050	0	0.00	0.00	0.00	20.57	$423	9	$159	0.37	29.95
318	0	0.00	0.00	0.00	11.76	$242	5	$91	0.37	29.92
319	0	0.00	0.00	0.00	11.76	$242	5	$91	0.37	29.92
2240	0	0.00	0.00	0.00	11.76	$242	5	$91	0.37	29.92
5074	0	0.00	0.00	0.00	44.08	$907	19	$341	0.37	29.92
4102	0	0.00	0.00	0.00	14.69	$302	6	$114	0.37	29.83
4102	4	0.00	0.00	0.00	58.76	$1209	24	$456	0.37	29.83
4113	0	0.00	0.00	0.00	14.69	$302	6	$114	0.37	29.83
4113	5	0.00	0.00	0.00	73.45	$1511	30	$570	0.37	29.83
	Total	0.00	0.00	0.00	3313.31	$68174	1154	$20,768	0.30	36.79

Note: Electric MBTU/Yr Savings from calculation work sheets have been calculated with 3,413 Site BTU/KWH.

ECO 11X BUILDING LIST

185 , 312 , 315 , 318 , 319 , 450 , 499 , 625 ,
627 , 628 , 629 , 630 , 631 , 634 , 635 , 636 ,
638 , 650 , 651 , 652 , 653 , 654 , 657 , 658 ,
659 , 660 , 730 , 731 , 732 , 735 , 736 , 738 ,
739 , 740 , 741 , 743 , 747 , 748 , 749 , 750 ,
753 , 754 , 755 , 756 , 815 , 816 , 817 , 818 ,
819 , 820 , 821 , 822 , 825 , 827 , 828 , 829 ,
830 , 831 , 832 , 836 , 838 , 842 , 1008 , 1009 ,
1012 , 1013 , 1014 , 1015 , 1016 , 1018 , 1028 , 1029 ,
1608 , 1700 , 1701 , 1702 , 1703 , 1704 , 1705 , 1706 ,
1707 , 1740 , 1750 , 2240 , 4100 , 4101 , 4102 , 4103 ,
4104 , 4110 , 4111 , 4112 , 4113 , 4114 , 4115 , 5050 ,
5052 , 5053 , 5074 , 5161 , 5169 , 5231 , 5301 , 5334 ,
5346 , 5350 , 5361 , 5374 , 5391 , 5500 , 5511 , 5531 ,
5592 , 5702 , 5732 , 5743

ECO #12: Replace motors with high efficiency motors

CURRENT SITUATION:

This project should be implemented as existing motors breakdown. As shown in the ECO calculation procedure section, the incremental cost to purchase high efficiency motors when motors are replaced, is a good investment.

Several large standard efficiency motors are in service at pumping stations. These pump motors have been replaced by diesel pumps at high electrical demand periods to reduce the peak demand. When average kilowatt-hour costs are used, replacement of these motors can be economically justified. One motor in the river water intake structure, the water supply plant and the sewerage treatment control center justify immediate replacement. Other motors should be replaced by high efficiency rather than standard efficiency motors as required.

PROPOSAL:

Replace four (4) motors in building #185, one (1) motor in building #1601 and one (1) motor in building #10250.

ECONOMICS:

The total costs, savings, Savings Investment Ratio (SIR) and simple payback are:

Electricity Savings Per Year: 375 MBTU	$ 7,717
Total Savings Per Year:	$ 7,717
Total Construction Cost:	$ 27,351
Simple Payback (YRS):	3.54
SIR:	3.11

ENERGY SAVING OPPORTUNITY STUDY

INDIVIDUAL ENERGY CONSERVATION OPPORTUNITY SAVINGS SUMMARY

ECO NUMBER: 12

HIGH EFFICIENCY MOTORS

ECO LIFE: 25 YEARS

BUILDING NUMBER	SIM BLDG	***** MBTU SAVINGS PER YEAR ******* #6 OIL	#2 OIL	LP GAS	ELECT	FUEL SAVINGS	OTHER SAVING	PROJECT COST	SIMPLE PAYBACK	SIR	
10250	0	0.00	0.00	0.00	254.58	$5238	0	$16,359	3.12	3.53	*R
1601	0	0.00	0.00	0.00	109.18	$2246	0	$8,870	3.95	2.79	
185	0	0.00	0.00	0.00	11.31	$233	0	$2,122	9.11	1.21	
	Total	0.00	0.00	0.00	375.07	$7717	0	$27,351	3.54	3.11	

Note: Electric MBTU/Yr Savings from calculation work sheets have been calculated with 3,413 Site BTU/KWH.

ECO #14: Install infrared radiant heaters

CURRENT SITUATION:

High ceiling areas are prone to heat stratification and generally, large amounts of infiltration from overhead doors. To reduce both of these problems, radiant heaters may be used to heat the objects in the space directly without using the air as a transfer medium.

There is not a standard calculation procedure to determine savings from the conversion to radiant heat. An ASHRAE study mentioned in the 1983 ASHRAE equipment handbook claims that savings may be up to 50%. We have claimed 35% savings, in agreement with the Co-Ray-Vac engineering manual.

Fort Leonard Wood personnel now claim to setback all buildings when they are unoccupied, so heating degree hours have been adjusted to consider the stated operating hours and days per week.

PROPOSAL:

Install radiant heaters in large open areas to reduce inefficiencies associated with convective heating systems.

ECONOMICS:

The total costs, savings, Savings Investment Ratio (SIR) and simple payback are:

Heating Energy Savings Per Year: 1749 MBTU	$ 13,392
Electricity Savings Per Year: 97 MBTU	$ 1,985
Total Savings Per Year	$ 15,377
Total Construction Cost:	$ 89,630
Simple Payback (YRS):	5.83
SIR:	2.46

ENERGY SAVING OPPORTUNITY STUDY

INDIVIDUAL ENERGY CONSERVATION OPPORTUNITY SAVINGS SUMMARY

ECO NUMBER: 14

INFRARED HEATERS

ECO LIFE: 25 YEARS

BUILDING NUMBER	SIM BLDG	***** MBTU SAVINGS PER YEAR ******* #6 OIL	#2 OIL	LP GAS	ELECT	FUEL SAVINGS	OTHER SAVING	PROJECT COST	SIMPLE PAYBACK	SIR	
5074	0	0.00	466.00	-303.00	13.83	$1690	0	$6,003	3.55	3.78	*R
672	0	0.00	257.00	-167.00	4.41	$867	0	$4,168	4.81	2.83	
672	10	0.00	2570.00	-1670.00	44.13	$8667	0	$41,680	4.81	2.83	
780	0	0.00	240.00	-156.00	4.12	$809	0	$4,168	5.15	2.64	
5122	0	0.00	83.00	-54.00	5.59	$365	0	$2,332	6.39	2.03	
5122	1	0.00	83.00	-54.00	5.59	$365	0	$2,332	6.39	2.03	
5150	0	0.00	0.00	190.00	7.65	$1088	0	$10,767	9.90	1.83	
5052	0	0.00	0.00	106.00	3.24	$586	0	$6,916	11.80	1.56	
5053	0	0.00	0.00	121.00	5.59	$708	0	$8,200	11.58	1.55	
2395	0	0.00	0.00	37.00	2.35	$230	0	$3,064	13.32	1.32	
	Total	0.00	3699.00	-1950.00	96.50	$15375	0	$89,630	5.83	2.46	
2250	0	0.00	46.00	-30.00	1.18	$163	0	$2,332	14.31	0.94	N

Note: Factor Electric MBTU/Yr Savings from calculation work sheets by (3,413 Site ÷ 11,600 Source BTU/KWH) to equal the Site MBTU/Yr savings on this summary page and on the LCCA pages.

ECO 14 BUILDING LIST

672 , 673 , 680 , 681 , 772 , 773 , 780 , 781 ,
990 , 991 , 998 , 999 , 2395 , 5052 , 5053 , 5074 ,
5122 , 5130 , 5150

ECO #15: Dry Bulb Economizer

CURRENT SITUATION:

Buildings that have existing air handling units with outside air and relief dampers may be modified to include economizer cycles at a reasonable cost.

PROPOSAL:

Utilize the proper equipment to install a drybulb economizer cycle on the air handling units that posses motor actuated return and outside air damper. Outside air temperature sensors would be installed as required along with the central control panel.

ECONOMICS:

The total costs, savings, Savings Investment Ratio (SIR) and simple payback are:

Electricity Savings Per Year: 2839 MBTU	$ 58,405
Total Construction Cost:	$ 21,780
Simple Payback (YRS):	0.37
SIR:	22.95

ENERGY SAVING OPPORTUNITY STUDY

INDIVIDUAL ENERGY CONSERVATION OPPORTUNITY SAVINGS SUMMARY

ECO NUMBER: 15

DRY BULB ECONOMIZER

ECO LIFE: 15 YEARS

BUILDING NUMBER	SIM BLDG	***** MBTU SAVINGS PER YEAR ******* #6 OIL	#2 OIL	LP GAS	ELECT	FUEL SAVINGS	OTHER SAVING	PROJECT COST	SIMPLE PAYBACK	SIR	
628	0	0.00	0.00	0.00	90.33	$1859	0	$376	0.20	42.31	*R
628	25	0.00	0.00	0.00	2258.17	$46462	0	$9,400	0.20	42.31	
821	0	0.00	0.00	0.00	42.37	$872	0	$376	0.43	19.85	
1750	0	0.00	0.00	0.00	33.54	$690	0	$376	0.54	15.71	
1750	1	0.00	0.00	0.00	33.54	$690	0	$376	0.54	15.71	
657	0	0.00	0.00	0.00	27.07	$557	0	$505	0.91	9.44	
657	7	0.00	0.00	0.00	189.48	$3899	0	$3,535	0.91	9.44	
1705	0	0.00	0.00	0.00	9.42	$194	0	$188	0.97	8.82	
500	0	0.00	0.00	0.00	9.12	$188	0	$188	1.00	8.54	
735	0	0.00	0.00	0.00	17.95	$369	0	$505	1.37	6.26	
1608	0	0.00	0.00	0.00	8.24	$170	0	$252	1.48	5.76	
822	0	0.00	0.00	0.00	5.59	$115	0	$188	1.63	5.24	
1010	0	0.00	0.00	0.00	10.89	$224	0	$376	1.68	5.10	
1010	1	0.00	0.00	0.00	10.89	$224	0	$376	1.68	5.10	
740	0	0.00	0.00	0.00	4.71	$97	0	$188	1.94	4.41	
740	11	0.00	0.00	0.00	51.78	$1065	0	$2,068	1.94	4.41	
1703	0	0.00	0.00	0.00	4.41	$91	0	$188	2.07	4.13	
1703	1	0.00	0.00	0.00	4.41	$91	0	$188	2.07	4.13	
5074	0	0.00	0.00	0.00	8.53	$176	0	$563	3.20	2.67	
499	0	0.00	0.00	0.00	2.65	$55	0	$188	3.42	2.48	
743	0	0.00	0.00	0.00	2.35	$48	0	$188	3.92	2.21	
743	3	0.00	0.00	0.00	7.06	$145	0	$564	3.89	2.21	
1008	0	0.00	0.00	0.00	2.35	$48	0	$188	3.92	2.21	
2399	0	0.00	0.00	0.00	1.77	$36	0	$188	5.22	1.65	
312	0	0.00	0.00	0.00	2.06	$42	0	$252	6.00	1.44	
	Total	0.00	0.00	0.00	2838.68	$58407	0	$21,780	0.37	22.95	
315	0	0.00	0.00	0.00	1.18	$24	0	$252	10.50	0.82	N
185	0	0.00	0.00	0.00	0.29	$6	0	$252	42.00	0.21	
	Total	0.00	0.00	0.00	1.47	$30	0	$504			

Note: Factor Electric MBTU/Yr Savings from calculation work sheets by (3,413 Site + 11,600 Source BTU/KWH) to equal the Site MBTU/Yr savings on this summary page and on the LCCA pages.

ECO 15 BUILDING LIST

312 , 499 , 500 , 625 , 627 , 628 , 629 , 630 ,
631 , 634 , 635 , 638 , 650 , 651 , 652 , 653 ,
654 , 657 , 658 , 659 , 660 , 730 , 731 , 732 ,
735 , 736 , 738 , 739 , 740 , 743 , 748 , 749 ,
750 , 753 , 754 , 755 , 756 , 815 , 816 , 817 ,
819 , 820 , 821 , 822 , 825 , 827 , 828 , 829 ,
830 , 831 , 832 , 836 , 838 , 842 , 1008 , 1009 ,
1010 , 1011 , 1018 , 1608 , 1703 , 1704 , 1705 , 1740 ,
1750 , 2399 , 5074

ECO #16: Domestic Hot Water Circulation

CURRENT SITUATION:

We have considered the pump savings to be realized by shutting the DHW circulation pump "OFF" when the building is unoccupied. Additional savings from reduced piping heat loss was also considered.

Many buildings no longer have domestic hot water. This ECO would not apply to them.

PROPOSAL:

Use timeclock operation schedules to turn off domestic hot water circulation pumps during unoccupied periods.

ECONOMICS:

The total costs, savings, Savings Investment Ratio (SIR) and simple payback are:

Heating Energy Savings Per Year: 962 MBTU	$ 3,577
Electricity Savings Per Year: 62	$ 1,278
Total Savings Per Year:	$ 4,855
Total Construction Cost:	$ 11,396
Simple Payback (YRS):	2.35
SIR:	6.82

ENERGY SAVING OPPORTUNITY STUDY

INDIVIDUAL ENERGY CONSERVATION OPPORTUNITY SAVINGS SUMMARY

ECO NUMBER: 16

CONTROL HW CIRC PUMP

ECO LIFE: 25 YEARS

BUILDING NUMBER	SIM BLDG	***** MBTU SAVINGS PER YEAR ******* #6 OIL	#2 OIL	LP GAS	ELECT	FUEL SAVINGS	OTHER SAVING	PROJECT COST	SIMPLE PAYBACK	SIR	
1608	0	0.00	0.00	89.86	1.06	$462	0	$154	0.33	56.72	*R
500	0	63.19	0.00	0.00	1.06	$242	0	$154	0.64	26.78	
1703	0	0.00	0.00	0.00	9.91	$204	0	$154	0.75	14.58	
1703	1	0.00	0.00	0.00	9.91	$204	0	$154	0.75	14.58	
318	0	0.00	14.08	0.00	0.43	$96	0	$154	1.60	10.09	
319	0	0.00	14.08	0.00	0.43	$96	0	$154	1.60	10.09	
315	0	0.00	0.00	12.48	1.06	$83	0	$154	1.86	9.22	
1750	0	18.93	0.00	0.00	0.45	$75	0	$154	2.05	8.22	
1750	1	18.93	0.00	0.00	0.45	$75	0	$154	2.05	8.22	
1720	0	16.25	0.00	0.00	0.43	$66	0	$154	2.33	7.12	
1720	10	162.50	0.00	0.00	4.30	$656	0	$1,540	2.35	7.12	
1769	0	15.60	0.00	0.00	0.43	$63	0	$154	2.44	6.86	
1014	0	9.10	0.00	0.00	1.77	$68	0	$154	2.26	6.24	
1014	5	45.50	0.00	0.00	8.85	$341	0	$770	2.26	6.24	
1016	0	9.10	0.00	0.00	1.77	$68	0	$154	2.26	6.24	
628	0	11.27	0.00	0.00	0.43	$48	0	$154	3.21	5.13	
628	25	281.75	0.00	0.00	10.75	$1204	0	$3,850	3.20	5.13	
747	0	9.53	0.00	0.00	0.43	$42	0	$154	3.67	4.44	
818	0	9.53	0.00	0.00	0.43	$42	0	$154	3.67	4.44	
1724	0	9.03	0.00	0.00	0.43	$40	0	$154	3.85	4.24	
1724	14	126.42	0.00	0.00	6.02	$565	0	$2,156	3.82	4.24	
1766	0	8.67	0.00	0.00	0.43	$39	0	$154	3.95	4.09	
1010	0	7.89	0.00	0.00	0.45	$37	0	$154	4.16	3.81	
1010	1	7.89	0.00	0.00	0.45	$37	0	$154	4.16	3.81	
	Total	831.08	28.16	102.34	62.13	$4853	0	$11,396	2.35	6.82	

Note: Electric MBTU/Yr Savings from calculation work sheets have been calculated with 3,413 Site BTU/KWH.

ECO 16 BUILDING LIST

315 , 318 , 319 , 500 , 627 , 628 , 629 , 634 ,
635 , 651 , 652 , 654 , 659 , 660 , 730 , 731 ,
736 , 738 , 747 , 748 , 755 , 756 , 815 , 816 ,
817 , 818 , 819 , 827 , 828 , 829 , 830 , 831 ,
1010 , 1011 , 1012 , 1013 , 1014 , 1015 , 1016 , 1028 ,
1029 , 1608 , 1703 , 1704 , 1720 , 1722 , 1723 , 1724 ,
1725 , 1726 , 1728 , 1729 , 1730 , 1731 , 1732 , 1733 ,
1734 , 1735 , 1740 , 1750 , 1761 , 1762 , 1763 , 1764 ,
1765 , 1766 , 1767 , 1768 , 1769 , 1771 , 1773 , 1774 ,
1775 , 1776

ECO #18: Decentralize Domestic Hot Water Heaters

CURRENT SITUATION:

This potential project has two sub-opportunities

1. Install point of use heaters in lieu of one heater per building.
   This allows the elimination of DHW circulation pumps and eliminates standby and line losses.

2. Remove DHW loads from the central plants or space heating boilers, allowing the larger boilers to be shut down for the non-heating seasons.

An ideal example of the first opportunity is Building #318. Fifty occupants reside in the facility which has twelve (12) pars of bathrooms and one laundry. The circulation losses calculated in ECO # 16, (14.08 MBH) total $96.19 per year at 40 hours per week, or $404.00 per year at 168 hours per week. The average daily hot water demand for a men's dormitory is 13.1 gallon/occupant according to ASHRAE Systems Handbook, 37.13, Table 6.

50 occupants x 13.1 gal/occ. day x 365 days x 8.34 BTU/gal degree x 80 degree = 159.5 MBTU/Yr

It would only be practical to install electric point of use water heaters. Fuel lines and flues would have to be installed for gas field units.

At the current electric rate of $20.575 per MBTU, 159.5 MBTU would cost $3,282 per year.

At a 65% existing water heater efficiency and a # 2 oil cost of $6.203 per MBTU, 159.5 MBTU would cost $1,522 per year. $1,522 plus the $404 line losses total $1,926, $1,356 less than the point of use heater fuel cost.

Regardless of construction cost, a system that is more costly to operate cannot be economically justified.

#2 oil is the most expensive fuel other than electricity, so point of use heaters may be discounted entirely.

Building #318 is also a candidate for single domestic water heater. The local boiler in this building is used for space heat and domestic water heating. The boiler has a high fire rate of 6.3 gallons per hour.

ENERGY SAVING OPPORTUNITY STUDY

INDIVIDUAL ENERGY CONSERVATION OPPORTUNITY SAVINGS SUMMARY

ECO NUMBER: 18

DEDICATED WATER HEATER

ECO LIFE: 25 YEARS

BUILDING NUMBER	SIM BLDG	***** MBTU SAVINGS PER YEAR ******* #6 OIL	#2 OIL	LP GAS	ELECT	FUEL SAVINGS	OTHER SAVING	PROJECT COST	SIMPLE PAYBACK	SIR	
312	0	0.00	200.21	0.00	0.00	$1242	0	$3,866	3.11	5.36	*R
318	0	0.00	108.87	0.00	0.00	$675	0	$4,543	6.73	2.48	
319	0	0.00	108.87	0.00	0.00	$675	0	$4,543	6.73	2.48	
	Total	0.00	417.95	0.00	0.00	$2592	0	$12,952	5.00	3.34	

ECO #21: Reduce HVAC Air Flow

CURRENT SITUATION:

Building air flow was measured and compared to the design requirements. Several buildings were found to have an excess amount of supply air, thereby wasting fan energy.

PROPOSAL:

Reduce the air flow in the air conditioning systems to more closely match the load on the system.

Also the system in Building 1705 should be rebalanced.

ECONOMICS:

The total costs, savings, Savings Investment Ratio (SIR) and simple payback are:

Electricity Savings Per Year: 8850 MBTU	$ 182,095
Total Construction Cost:	$ 29,927
Simple Payback (YRS):	0.16
SIR:	52.08

ENERGY SAVING OPPORTUNITY STUDY

INDIVIDUAL ENERGY CONSERVATION OPPORTUNITY SAVINGS SUMMARY

ECO NUMBER: 21

REDUCE AIR FLOW

ECO LIFE: 15 YEARS

BUILDING NUMBER	SIM BLDG	***** MBTU SAVINGS PER YEAR ******* #6 OIL	#2 OIL	LP GAS	ELECT	FUEL SAVINGS	OTHER SAVING	PROJECT COST	SIMPLE PAYBACK	SIR	
628	0	0.00	0.00	0.00	309.19	$6362	0	$829	0.13	65.69	*R
628	25	0.00	0.00	0.00	7729.78	$159040	0	$20,725	0.13	65.69	
821	0	0.00	0.00	0.00	120.64	$2482	0	$561	0.23	37.87	
1750	0	0.00	0.00	0.00	121.25	$2495	0	$689	0.28	30.99	
1750	1	0.00	0.00	0.00	121.25	$2495	0	$689	0.28	30.99	
1705	0	0.00	0.00	0.00	33.45	$688	0	$354	0.51	16.64	
657	0	0.00	0.00	0.00	49.89	$1026	0	$689	0.67	12.75	
657	7	0.00	0.00	0.00	349.24	$7186	0	$4,823	0.67	12.75	
2399	0	0.00	0.00	0.00	11.34	$233	0	$214	0.92	9.33	
1608	0	0.00	0.00	0.00	4.44	$91	0	$354	3.89	2.21	
	Total	0.00	0.00	0.00	8850.47	$182098	0	$29,927	0.16	52.08	

Note: Factor Electric MBTU/Yr Savings from calculation work sheets by (3,413 Site ÷ 11,600 Source BTU/KWH) to equal the Site MBTU/Yr savings on this summary page and on the LCCA pages.

ECO 21 BUILDING LIST

627 , 628 , 629 , 630 , 634 , 635 , 651 , 652 ,
653 , 654 , 657 , 659 , 660 , 730 , 731 , 736 ,
738 , 739 , 748 , 749 , 754 , 755 , 756 , 815 ,
816 , 817 , 819 , 820 , 821 , 827 , 828 , 829 ,
830 , 831 , 836 , 1608 , 1705 , 1740 , 1750 , 2399

ECO #23: Time Clocks

CURRENT SITUATION:

Timeclocks may provide the stop/start, and a night thermostat, the set-back function of an EMCS where monitoring, program security and program flexibility are not required.

PROPOSAL:

Provide stop/start in selected buildings not proposed to be included in the EMCS loop. (Building 185, 672, 780 & 5150)

ECONOMICS:

The total costs, savings, Savings Investment Ratio (SIR) and simple payback are:

Heating Energy Savings Per Year: 1894 MBTU	$ 11,332
Electricity Savings Per Year: 173 MBTU	$ 3,566
Total Savings Per Year:	$ 14,898
Total Construction Cost:	$ 25,332
Simple Payback (YRS):	1.70
SIR:	6.30

ENERGY SAVING OPPORTUNITY STUDY

INDIVIDUAL ENERGY CONSERVATION OPPORTUNITY SAVINGS SUMMARY

ECO NUMBER: 23

INSTALL TIME CLOCKS

ECO LIFE: 15 YEARS

BUILDING NUMBER	SIM BLDG	***** MBTU SAVINGS PER YEAR ******* #6 OIL	#2 OIL	LP GAS	ELECT	FUEL SAVINGS	OTHER SAVING	PROJECT COST	SIMPLE PAYBACK	SIR	
5150	0	0.00	0.00	318.62	21.08	$1995	0	$1,846	0.93	12.77	*R
185	0	0.00	46.82	0.00	8.33	$462	0	$626	1.35	7.56	
780	0	0.00	153.61	0.00	14.46	$1250	0	$1,905	1.52	6.96	
672	0	0.00	124.97	0.00	11.77	$1017	0	$1,905	1.87	5.66	
672	10	0.00	1249.70	0.00	117.66	$10173	0	$19,050	1.87	5.66	
	Total	0.00	1575.10	318.62	173.30	$14897	0	$25,332	1.70	6.30	

Note: Factor Electric MBTU/Yr Savings from calculation work sheets by (3,413 Site + 11,600 Source BTU/KWH) to equal the Site MBTU/Yr savings on this summary page and on the LCCA pages.

ECO 23 BUILDING LIST

185 , 672 , 673 , 680 , 681 , 772 , 773 , 780 ,
781 , 990 , 991 , 998 , 999 , 5150

ECO #31: Dishwasher Heat Recovery

CURRENT SITUATION:

Effluent from the dishwashers at a temperature of about 130 degrees is drained directly to the sewer. Heat may be recovered from the drain water to preheat domestic hot water make-up water.

Typical mess-hall dishwashers are manufactured by Blakeslee and use from 288 to 420 gallons per hour.

Dishwasher drain flow and make-up flows are not equal, so the dishwasher must drain into a holding tank to be continuously pumped through a heat exchanger. A float in the storage tank will turn the pump on when there is sufficient water for continuous pumping. A screen filter in the tank will need to be cleaned daily to remove broken glass and garage that would otherwise clog the heat exchanger. Each meals final rinse cycle will drain without a make-up requirement. This hot rinse should melt and remove grease that may have hardened in the heat exchanger.

PROPOSAL:

Install a dishwasher drainage tank with a removable top, screen filter discharge, float switch and pump along with a heat exchanger to preheat domestic hot water make-up. Feasibility is limited to areas local to the dish washing facility.

ECONOMICS:

The total costs, savings, Savings Investment Ratio (SIR) and simple payback are:

Heating Energy Savings Per Year: 3188 MBTU	$ 11,127
Electricity Savings Per Year: -10 MBTU	$ - 196
Maintenance Savings	$ 0
Total Savings Per Year:	$ 10,931
Total Construction Cost:	$ 43,960
Simple Payback (YRS):	4.02
SIR:	4.41

ENERGY SAVING OPPORTUNITY STUDY

INDIVIDUAL ENERGY CONSERVATION OPPORTUNITY SAVINGS SUMMARY

ECO NUMBER: 31

WASTE HEAT RECOVERY

ECO LIFE: 25 YEARS

BUILDING NUMBER	SIM BLDG	***** MBTU SAVINGS PER YEAR ******* #6 OIL	#2 OIL	LP GAS	ELECT	FUEL SAVINGS	OTHER SAVING	PROJECT COST	SIMPLE PAYBACK	SIR	
657	0	227.74	0.00	0.00	-0.69	$781	0	$3,140	4.02	4.41	*R
657	7	1594.18	0.00	0.00	-4.86	$5464	0	$21,980	4.02	4.41	
735	0	227.74	0.00	0.00	-0.69	$781	0	$3,140	4.02	4.41	
821	0	227.74	0.00	0.00	-0.69	$781	0	$3,140	4.02	4.41	
1010	0	227.74	0.00	0.00	-0.69	$781	0	$3,140	4.02	4.41	
1010	1	227.74	0.00	0.00	-0.69	$781	0	$3,140	4.02	4.41	
1750	0	227.74	0.00	0.00	-0.69	$781	0	$3,140	4.02	4.41	
1750	1	227.74	0.00	0.00	-0.69	$781	0	$3,140	4.02	4.41	
	Total	3188.36	0.00	0.00	-9.69	$10931	0	$43,960	4.02	4.41	

Note: Factor Electric MBTU/Yr Savings from calculation work sheets by (3,413 Site ÷ 11,600 Source BTU/KWH) to equal the Site MBTU/Yr savings on this summary page and on the LCCA pages.

ECO 31 BUILDING LIST

630 , 653 , 657 , 735 , 739 , 749 , 754 , 820 ,
821 , 836 , 1010 , 1011 , 1740 , 1750

ECO #32: Chilled Water Storage

CURRENT SITUATION:

Some buildings have local chillers that provide cooling when central plant chillers are throttled to limit demand or are the sole source of chilled water.

Chilled water could be generated during off peak hours for use when electric demand is greatest. The chilled water would have to be kept at a usable temperature until it was called for.

Implementation of a chilled water storage project would not save energy in fact it could increase actual BTU consumption. It would save electric demand. The rate structure at Ft. Leonard Wood, with a 100% demand ratchet would allow full realization of demand savings.

PROPOSAL:

Install insulated underground storage tanks, piping and controls to provide chilled water for up to 4 hours continuously, after storage of that water for up to 8 hours.

ECONOMICS:

The total costs, savings, Savings Investment Ratio (SIR) and simple payback are:

Electricity Demand Savings Per Year: 0 MBTU	$ 21,403
Total Construction Cost:	$ 70,356
Simple Payback (YRS):	3.29
SIR:	3.52 NON-ECIP

FORT LEONARD WOOD

ESOS

INDIVIDUAL ENERGY CONSERVATION OPPORTUNITY SAVINGS SUMMARY

ECO NUMBER: 32

CHILLED WATER STORAGE

ECO LIFE: 25 YEARS

BUILDING NUMBER	SIM BLDG	***** MBTU SAVINGS PER YEAR ******* #6 OIL	#2 OIL	LP GAS	ELECT	ENERGY SAVINGS	OTHER SAVING	PROJECT COST	SIMPLE PAYBACK	SIR	
499	0	0.00	0.00	0.00	0.00	$0	21403	$70,356	3.29	3.52	*R
821	0	0.00	0.00	0.00	0.00	$0	11826	$54,033	4.57	2.53	
822	0	0.00	0.00	0.00	0.00	$0	5287	$30,177	5.71	2.01	
312	0	0.00	0.00	0.00	0.00	$0	7235	$41,937	5.80	1.99	
450	0	0.00	0.00	0.00	0.00	$0	7304	$42,262	5.79	1.99	
500	0	0.00	0.00	0.00	0.00	$0	5797	$41,724	7.20	1.60	
5050	0	0.00	0.00	0.00	0.00	$0	4151	$30,177	7.27	1.58	
315	0	0.00	0.00	0.00	0.00	$0	10794	$81,239	7.53	1.54	
1705	0	0.00	0.00	0.00	0.00	$0	3791	$30,177	7.96	1.44	
4113	0	0.00	0.00	0.00	0.00	$0	2655	$25,666	9.67	1.18	
4113	5	0.00	0.00	0.00	0.00	$0	13275	$128,330	9.67	1.18	
741	0	0.00	0.00	0.00	0.00	$0	3954	$39,135	9.90	1.16	
	Total	0.00	0.00	0.00	0.00	$0	97472	$615,213			
318	0	0.00	0.00	0.00	0.00	$0	2273	$27,815	12.24	0.93	N
319	0	0.00	0.00	0.00	0.00	$0	2273	$27,815	12.24	0.93	
636	0	0.00	0.00	0.00	0.00	$0	3154	$39,135	12.41	0.92	
	Total	0.00	0.00	0.00	0.00	$0	7700	$94,765			

ECO #33: Steam Trap Inspection/Replacement

CURRENT SITUATION:

Steam is used directly for space heating in several buildings at Fort Leonard Wood.

PROPOSAL:

Replace steam traps which are worn or malfunctioning. A regular steam trap maintenance program will eliminate live steam returning to the boiler and improve boiler efficiency, fuel economy, and equipment capacity.

ECONOMICS:

The total costs, savings, Savings Investment Ratio (SIR) and simple payback are:

Fuel Savings Per Trap Per Year: # 6 Oil, Central Plant (MBTU/YR 29.57)	$ 103
Total Construction Cost Per Trap:	$ 91
Simple Payback (YRS):	.88
SIR: (25 Yr Life per ECIP Guidance)	19.97
(With conservative 7 Yr Life)	6.81

Calculations are based on conservative figures for replacing one steam trap in a building with short hours of operation, using #6 oil (the least expensive fuel), and a high system efficiency. Actual savings can be expected to be higher for buildings have a more expensive fuel, longer hours of operation, or lower system efficiency.

ECO #34: Interlock kitchen ventilation to cooking equipment.

CURRENT SITUATION:

Mess-hall kitchen exhaust and make-up air units are currently turned on in the morning when the cooks arrive and remain on until they depart at night.

These ventilation units are actually only required when the apparatus (range, dishwasher, etc.,) they serve are in operation.

PROPOSAL:

Install an interlock system to power the kitchen equipment and their dedicated exhaust hood units when equipment they serve is in operation. Install time delay relays to provide a lag period after equipment shutdown to sufficiently purge the system.

ECONOMICS:

The total costs, savings, Savings Investment Ratio (SIR) and simple payback are:

Heating Energy Savings Per Year: 1919 MBTU	$ 6,698
Electricity Savings Per Year: 165 MBTU	$ 3,397
Total Savings Per Year:	$ 10,095
Total Construction Cost:	$ 36,034
Simple Payback (YRS):	3.57
SIR:	3.03

ENERGY SAVING OPPORTUNITY STUDY

INDIVIDUAL ENERGY CONSERVATION OPPORTUNITY SAVINGS SUMMARY

ECO NUMBER: 34

INTERLOCK KITCHEN VENTS

ECO LIFE: 15 YEARS

BUILDING NUMBER	SIM BLDG	***** MBTU SAVINGS PER YEAR ******* #6 OIL	#2 OIL	LP GAS	ELECT	FUEL SAVINGS	OTHER SAVING	PROJECT COST	SIMPLE PAYBACK	SIR	
1750	0	421.17	0.00	0.00	31.26	$2113	0	$3,896	1.84	5.93	*R
1750	1	421.17	0.00	0.00	31.26	$2113	0	$3,896	1.84	5.93	
821	0	225.17	0.00	0.00	12.48	$1043	0	$3,896	3.74	4.59	
657	0	72.70	0.00	0.00	7.14	$401	0	$1,948	4.86	2.20	
657	7	508.90	0.00	0.00	49.97	$2804	0	$13,636	4.86	2.20	
735	0	153.41	0.00	0.00	22.50	$998	0	$4,866	4.88	2.00	
1010	0	58.39	0.00	0.00	5.24	$312	0	$1,948	6.24	1.73	
1010	1	58.39	0.00	0.00	5.24	$312	0	$1,948	6.24	1.73	
	Total	1919.30	0.00	0.00	165.09	$10096	0	$36,034	3.57	3.03	

Note: Factor Electric MBTU/Yr Savings from calculation work sheets by (3,413 Site ÷ 11,600 Source BTU/KWH) to equal the Site MBTU/Yr savings on this summary page and on the LCCA pages.

ECO 34 BUILDING LIST

630 , 653 , 657 , 735 , 739 , 749 , 754 , 820 ,
821 , 836 , 1010 , 1011 , 1740 , 1750

ECO #35: Ventilation Fan Control

CURRENT SITUATION:

Ten Hundred series barracks have numerous ventilation fans that are in operation continuously.

Ventilation could be curtailed when the structures are unoccupied.

PROPOSAL:

Install control systems comprising timeclocks and manual switches to turn fans "OFF" when they are not required.

ECONOMICS:

The total costs, savings, Savings Investment Ratio (SIR) and simple payback are:

Electricity Savings Per Year: 43 MBTU	$ 890
Total Construction Cost:	$ 2,107
Simple Payback (YRS):	2.37
SIR:	3.62

ENERGY SAVING OPPORTUNITY STUDY

INDIVIDUAL ENERGY CONSERVATION OPPORTUNITY SAVINGS SUMMARY

ECO NUMBER: 35

SHUT OFF VENT FANS

ECO LIFE: 15 YEARS

BUILDING NUMBER	SIM BLDG	***** MBTU SAVINGS PER YEAR ******* #6 OIL	#2 OIL	LP GAS	ELECT	FUEL SAVINGS	OTHER SAVING	PROJECT COST	SIMPLE PAYBACK	SIR	
1014	0	0.00	0.00	0.00	6.18	$127	0	$301	2.37	3.62	*R
1014	5	0.00	0.00	0.00	30.89	$636	0	$1,505	2.37	3.62	
1016	0	0.00	0.00	0.00	6.18	$127	0	$301	2.37	3.62	
	Total	0.00	0.00	0.00	43.25	$890	0	$2,107	2.37	3.62	

Note: Factor Electric MBTU/Yr Savings from calculation work sheets by (3,413 Site + 11,600 Source BTU/KWH) to equal the Site MBTU/Yr savings on this summary page and on the LCCA pages.

ECO 35 BUILDING LIST

1012 , 1013 , 1014 , 1015 , 1016 , 1028 , 1029

TABLE 1

Ft. Leonard Wood
Contract DACA41-85-C-0112

LIST OF BUILDINGS

ABBREVIATIONS:

M.H.	- Mess Hall	AD. & ST.	- Administration & Storage
B.H.	- Bachelor Housing	Maint.	- Maintenance
P.P.	- Power Plant	Train.	- Training
Hosp.	- Hospital	Ut.	- Utility Plant
Stor.	- Storage	Ed.	- Education
Oper.	- Operation	M.P.	- Multipurpose
Admin.	- Administration	C.Stor.	- Cold Storage
D.C.	- Dental Clinic	Latr.	- Latrine
M.O.	- Medical Orderly Rooms	D.K.	- Dog Kennel

BLDG. NUMBER	SQUARE FOOTAGE	FUNCTION
185	1644	U.T.
312	21594	B.H.
315	42957	Admin.
318	12174	B.H.
319	12174	B.H.
320	2617	M.O.
450	12056	Chapel
499	40635	Ed.
500	14569	D.C.
562	2400	B.H.
565	2400	Latr.
628	40640	B.H.
636	9236	Oper.
655	12134	AD. & ST.
657	13280	M.H.
672	4786	Maint.
734	12155	AD. & ST.
735	13280	M.H.
740	6163	Admin.
741	9236	Oper.
743	3700	Hosp.
747	40640	B.H.
780	4786	Maint.
801	17012	Audio Visual
818	40640	B.H.
821	13280	M.H.
822	6163	Oper.
823	12155	Admin.
1006	12155	Admin.
1008	6163	Oper.
1010	11316	M.H.
1014	40639	B.H.
1016	40639	B.H.
1601	7664	P.P.
1608	12960	D.C.
1700	2341	Stor.
1701	23411	Oper.
1703	19096	Oper.
1705	7930	Admin.
1720	24667	B.H.
1724	11343	B.H.
1750	12929	M.H.
1766	11343	B.H.
1769	24667	B.H.
2240	1308	D.K.
2250	1862	Maint.
2317	6510	C.Stor.
2347	6510	C.Stor.
2348	6510	C.Stor.
2395	2600	Stor.
2399	2126	Hosp.
4102	22003	B.H.
4113	11430	B.H.
5050	7436	Train.
5052	14480	Train.
5053	29225	Maint.
5074	32044	Ed.
5122	1800	Train.
5150	12667	Train.
5231	1700	M.P.
10250	2546	Ut.

TABLE 2

ECO/BUILDING MATRIX

ENERGY CONSERVATION MEASURES

BUILDING	1	1A	1B	2	7	10	11X	12	14	15	16	18	21	23	31	32	34	35
185						X	X	X						X				
312	X			X	X	X	X			X		X						
315	X			X			X				X							
318				X			X				X	X						
319				X			X				X	X						
320					X													
450				X		X	X											
499	X			X		X	X			X						X		
500					X	X				X	X							
561		X	X	X														
562		X	X	X														
563		X	X	X														
564		X	X	X														
565		X	X	X														
565		X	X	X		X												
566		X	X	X														
567		X	X	X														
568		X	X	X														
569		X	X	X														
625	X					X	X			X								
626	X					X												
627	X					X	X			X	X		X					
628	X				X	X	X			X	X		X					
629	X					X	X			X	X		X					
630	X					X	X			X			X		X		X	
631	X					X	X			X								
633	X					X												
634	X					X	X			X	X		X					
635	X					X	X			X	X		X					
636	X						X											
638	X					X	X			X								
650	X					X	X			X								
651	X					X	X			X	X		X					
652	X					X	X			X	X		X					
653	X					X	X			X			X		X		X	
654	X					X	X			X	X		X					

Revised 8/14/87

TABLE 2

ECO/BUILDING MATRIX

ENERGY CONSERVATION MEASURES

BUILDING	1	1A	1B	2	7	10	11X	12	14	15	16	18	21	23	31	32	34	35
655	X					X												
656	X					X												
657	X				X	X	X			X			X		X		X	
658	X					X	X			X								
659	X					X	X			X	X		X					
660	X					X	X			X	X		X					
664		X	X	X														
665		X	X	X														
666		X	X	X														
667		X	X	X														
668		X	X	X														
669		X	X	X														
672						X			X					X				
673						X			X					X				
680						X			X					X				
681						X			X					X				
686		X	X	X														
687		X	X	X														
688		X	X	X		X												
689		X	X	X														
690		X	X	X														
691		X	X	X														
692		X	X	X														
693		X	X	X														
694		X	X	X														
701		X	X	X														
702		X	X	X														
703		X	X	X		X												
704		X	X	X														
705		X	X	X														
706		X	X	X														
707		X	X	X														
709		X	X	X														
710		X	X	X														
711		X	X	X														
712		X	X	X														

TABLE 2

ECO/BUILDING MATRIX

ENERGY CONSERVATION MEASURES

BUILDING	1	1A	1B	2	7	10	11X	12	14	15	16	18	21	23	31	32	34	35
713		X	X	X		X												
714		X	X	X														
715		X	X	X														
716		X	X	X														
717		X	X	X														
718		X	X	X														
719		X	X	X														
720		X	X	X														
721		X	X	X														
722		X	X	X		X												
723		X	X	X														
724		X	X	X														
725		X	X	X														
726		X	X	X														
727		X	X	X														
728		X	X	X														
730	X					X	X			X	X		X					
731	X					X	X			X	X		X					
732	X					X	X			X								
733	X					X												
734	X					X												
735	X					X	X			X					X		X	
736	X					X	X			X	X		X					
738	X					X	X			X	X		X					
739	X					X	X			X			X		X		X	
740	X					X	X			X								
741	X					X	X											
743	X				X	X	X			X								
747	X						X				X							
748	X					X	X			X	X		X					
749	X					X	X			X			X		X		X	
750	X					X	X			X								
751	X					X												
752	X					X												
753	X					X	X			X								
754	X					X	X			X			X		X		X	

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TABLE 2

ECO/BUILDING MATRIX

ENERGY CONSERVATION MEASURES

BUILDING	1	1A	1B	2	7	10	11X	12	14	15	16	18	21	23	31	32	34	35
755	X					X	X			X	X		X					
756	X					X	X			X	X		X					
758		X	X	X														
759		X	X	X														
760		X	X	X		X												
761		X	X	X														
762		X	X	X														
763		X	X	X														
764		X	X	X														
765		X	X	X														
766		X	X	X														
772						X			X					X				
773						X			X					X				
780						X			X					X				
781						X			X					X				
790		X	X	X														
791		X	X	X														
792		X	X	X		X												
793		X	X	X														
794		X	X	X														
795		X	X	X														
796		X	X	X														
797		X	X	X														
798		X	X	X														
801		X	X	X														
806		X	X	X														
807		X	X	X														
808		X	X	X														
809		X	X	X														
810		X	X	X														
811		X	X	X		X												
812		X	X	X														
813		X	X	X														
814		X	X	X														
815	X					X	X			X	X		X					
816	X					X	X			X	X		X					

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TABLE 2

ECO/BUILDING MATRIX

ENERGY CONSERVATION MEASURES

BUILDING	1	1A	1B	2	7	10	11X	12	14	15	16	18	21	23	31	32	34	35
817	X					X	X			X	X		X					
818	X						X				X							
819	X					X	X			X	X		X					
820	X					X	X			X			X		X		X	
821	X					X	X			X			X		X		X	
822	X					X	X			X								
823	X					X												
824	X					X												
825	X					X	X			X								
827	X					X	X			X	X		X					
828	X					X	X			X	X		X					
829	X					X	X			X	X		X					
830	X					X	X			X	X		X					
831	X					X	X			X	X		X					
832	X					X	X			X								
836	X					X	X			X			X		X		X	
838	X					X	X			X								
840	X					X												
841	X					X												
842	X					X	X			X								
851		X	X	X														
852		X	X	X														
853		X	X	X		X												
854		X	X	X														
855		X	X	X														
856		X	X	X														
857		X	X	X														
858		X	X	X														
859		X	X	X														
990						X			X					X				
991						X			X					X				
998						X			X					X				
999						X			X					X				
1006	X					X												
1007	X					X												
1008	X					X	X			X								

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TABLE 2

ECO/BUILDING MATRIX

ENERGY CONSERVATION MEASURES

BUILDING	1	1A	1B	2	7	10	11X	12	14	15	16	18	21	23	31	32	34	35
1009	X					X	X			X								
1010	X				X	X				X	X				X		X	
1011	X					X				X	X				X		X	
1012	X						X				X							X
1013	X						X				X							X
1014	X				X		X				X							X
1015	X						X				X							X
1016	X						X				X							X
1018	X					X	X			X								
1025	X					X												
1028	X						X				X							X
1029	X						X				X							X
1601	X			X		X		X										
1608					X	X	X			X	X		X					
1700				X			X											
1701							X											
1702							X											
1703							X			X	X							
1704							X			X	X							
1705							X			X			X					
1706							X											
1707							X											
1720					X	X					X							
1722						X					X							
1723						X					X							
1724					X	X					X							
1725						X					X							
1726						X					X							
1728						X					X							
1729						X					X							
1730						X					X							
1731						X					X							
1732						X					X							
1733						X					X							
1734						X					X							
1735						X					X							

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TABLE 2

ECO/BUILDING MATRIX

ENERGY CONSERVATION MEASURES

BUILDING	1	1A	1B	2	7	10	11X	12	14	15	16	18	21	23	31	32	34	35
1740							X			X	X		X		X		X	
1750					X		X			X	X		X		X		X	
1761						X					X							
1762						X					X							
1763						X					X							
1764						X					X							
1765						X					X							
1766					X	X					X							
1767						X					X							
1768						X					X							
1769					X	X					X							
1771						X					X							
1773						X					X							
1774						X					X							
1775						X					X							
1776						X					X							
2240							X											
2250					X													
2317																		
2347																		
2348																		
2395				X					X									
2399				X	X	X				X			X					
4100	X			X			X											
4101	X			X			X											
4102	X			X			X											
4103	X			X			X											
4104	X			X			X											
4110							X											
4111							X											
4112							X											
4113					X		X											
4114							X											
4115							X											
5050				X		X	X											
5052				X			X		X									

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CONTRACT NO DACA41-85-C-011

ECO/BUILDING MATRIX

ENERGY CONSERVATION MEASURES

BUILDING	1	1A	1B	2	7	10	11X	12	14	15	16	18	21	23	31	32	34	35
5053				X		X	X		X									
5074				X	X		X		X	X								
5122									X									
5130									X									
5150				X					X						X			
5161							X											
5169							X											
5231							X											
5301							X											
5334							X											
5346							X											
5350							X											
5361							X											
5374							X											
5391							X											
5500							X											
5511							X											
5531							X											
5592							X											
5702							X											
5732							X											
5743							X											
10250								X										

TABLE 3

COMPLETE BUILDING LIST

ALL STUDIED AND SIMILAR BUILDINGS

185	668	734	811	1013	1775
312	669	735	812	1014	1776
315	672	736	813	1015	2240
318	673	738	814	1016	2250
319	680	739	815	1018	2317
320	681	740	816	1025	2347
450	686	741	817	1028	2348
499	687	743	818	1029	2395
500	688	747	819	1601	2399
561	689	748	820	1608	4100
562	690	749	821	1700	4101
563	691	750	822	1701	4102
564	692	751	823	1702	4103
565	693	752	824	1703	4104
565	694	753	825	1704	4110
566	701	754	827	1705	4111
567	702	755	828	1706	4112
568	703	756	829	1707	4113
569	704	758	830	1720	4114
625	705	759	831	1722	4115
626	706	760	832	1723	5050
627	707	761	836	1724	5052
628	709	762	838	1725	5053
629	710	763	840	1726	5074
630	711	764	841	1728	5122
631	712	765	842	1729	5130
633	713	766	851	1730	5150
634	714	772	852	1731	5161
635	715	773	853	1732	5169
636	716	780	854	1733	5231
638	717	781	855	1734	5301
650	718	790	856	1735	5334
651	719	791	857	1740	5346
652	720	792	858	1750	5350
653	721	793	859	1761	5361
654	722	794	990	1762	5374
655	723	795	991	1763	5391
656	724	796	998	1764	5500
657	725	797	999	1765	5511
658	726	798	1006	1766	5531
659	727	801	1007	1767	5592
660	728	806	1008	1768	5702
664	730	807	1009	1769	5732
665	731	808	1010	1771	5743
666	732	809	1011	1773	10250
667	733	810	1012	1774	